Capacity Auction Reforms: Seasonal/Accreditation (CAR-SA)

Resource Accreditation Modeling Impact Analysis Follow-up

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MARKET DEVELOPMENT & SYSTEM PLANNING

CAR-SA Project Overview

WMPP ID: 185

Proposed Effective Date: Q2 2027

- The ISO is providing an Impact Analysis (IA) that shows the potential quantitative and qualitative impacts of the CAR proposal. This analysis will provide stakeholders with a better understanding of how CAR may impact how much capacity they can sell, and wholesale market revenues and costs under specific scenarios, as well as other key parameters
- This presentation builds upon previous MC discussions as follows:
  - March: Resource Accreditation Modeling IA: preliminary results
  - February: Resource Accreditation Modeling IA Follow-Up
  - January & December: Introductory Presentations
- Overview of Today's Discussion:
  - Additional discussion of preliminary Near-Term Base Case results discussed in March
  - Gas MRI curve
  - Sensitivity and Additional Analysis: Storage Charging/Discharging Order
  - Sensitivity and Additional Analysis: 80/20 risk split
  - Future Cases 1 through 3
  - Continued Design Considerations
  - There are additional materials included in the appendices

Purpose of the IA & Results Interpretation

- The Resource Accreditation Modeling IA aims to use the RAA model outcomes generated based on a set of input assumptions to provide the region with directional information about the CAR design
- These IA results should not be interpreted as ISO predictions or forecasts of future model or market outcomes
- Modeling multiple cases will help stakeholders develop their own expectations about the potential impacts of CAR under a range of potential conditions

Limitations of the IA Modeling

- The IA uses assumptions about the resource mix, key input parameters associated with each resource, and the load forecast that are likely to be different under various and unknown future conditions or actual market behaviors
- The IA results are generally consistent with the design as it is proposed today, but may not reflect the final proposal for numerous reasons, including:
  - The potential for updates to the design based on continued ISO assessment and discussion with stakeholders
  - The translation of the proposal into production software may require further refinement of design elements
- For details of the assumptions and model inputs for the cases in this presentation, see Appendix A of the March Resource Accreditation Modeling IA presentation
- The data and outputs provided are shared in a summarized manner to comply with the information policy

ADDITIONAL DISCUSSION OF NEAR-TERM BASE CASE RESULTS

Further Information on Supply/Demand Conditions

- In the March Resource Accreditation Modeling IA slides, the ISO walked through how the CAR proposal would impact demand parameters (e.g., change to NICR) and supply parameters (accreditation values)
- Some stakeholders noted it was challenging to connect these two components in a way that explains the broader implications of the proposal on the supply/demand parameters that will inform auction outcomes
  - Put another way, under current rules, the system is modeled as having significantly more capacity than its annual 1-in-10 requirement. How would this change under CAR?
- Next: Seek to help connect these dots

Near-Term Base Case: System Conditions Under Current Rules

- Under current rules, after netting out Passive Demand Response resources, the NICR, when measured in QC, is 28,243 MW (March MC, slide 28)
- Total assumed available QC is 33,305 (March MC, slide 67)
- Taken together, this results in the ‘excess’ capacity:
  - Assumed available capacity is 17.9% greater than NICR
  - In MW terms, this ‘excess’ is 5,062 MW

Near-Term Base Case: Summer System Conditions Under CAR-SA

- Under CAR-SA, the summer NICR, when measured in MRIC, is 23,631 MW (March MC, slide 39)
- Total assumed available MRIC is 27,362 MW (March MC, slide 67)
- Taken together, this results in the ‘excess’ capacity:
  - Assumed available capacity is 15.8% greater than NICR
  - In MW terms, this ‘excess’ is 3,371 MW
- The percent change is similar, but slightly lower than under current rules, where this reflects a number of factors (March MC, slide 28), including:
  - A more stringent summer LOLE target
  - Modeling enhancements for IPRs, limited energy resources, and storage

Near-Term Base Case: Winter System Conditions Under CAR-SA

- Under CAR-SA, the winter NICR, when measured in MRIC, is 19,819 MW (March MC, slide 40)
- Total assumed available MRIC is 26,083 MW (March MC, slide 67)
- Taken together, this results in the 'excess' capacity:
  - Assumed available capacity is 31.6% greater than NICR
  - In MW terms, this 'excess' is 6,266 MW
- Important observation: While this excess appears significantly greater than in the summer, it does not directly account for the fact that the gas constraint is expected to limit the amount of non-firm gas capacity that sells in the winter
  - We may therefore expect system conditions to be tighter after considering the gas constraint

Recap: Near-Term Base Case Supply/Demand Conditions

- In the Near-Term Base Case, there is sufficient assumed capacity supply to satisfy the criterion quantities:
  - Under current rules at the annual level when measured in QC
  - Under CAR-SA for both summer and winter when measured in MRIC
- The 'excess' in summer capacity under CAR-SA decreases slightly from the current rules value (from 17.9% to 15.8%), reflecting numerous design and modeling changes, including the stricter 0.05 LOLE criterion
- The 'excess' in the winter increases significantly from the current rules value (17.9% to 31.6%), but this does not account for the gas constraint (discussed further next)

GAS MRI CURVE

Overview: Winter Gas Capacity Market Constraint

- As discussed in earlier committee meetings, the ISO's proposal includes a winter gas constraint to represent the limited gas available to the region during cold winter periods
  - This regional infrastructure limitation is not reflected in resource-level accreditation values
  - A high-level overview was provided in December MC/RC presentation
- The gas constraint will be derived based on the marginal reliability impact of shifting a MW of capacity from rest-of-system to behind this constraint
  - This is done in GE MARS using a methodology that is similar to that applied to derive the MRI curves for export-constrained capacity zones
  - At higher capacity levels, the constraint will specify a negative price to reflect that non-firm gas provides less reliability value than other capacity
  - More detailed discussion of the framework was provided in January memo and presentation

Overview: Winter Gas Capacity Market Constraint (cont.)

- To calculate the marginal reliability impact of gas capacity in GE MARS, the ISO has worked with the Analysis Group to develop profiles that estimate the distribution of gas available for electric generation
- These profiles are mapped to historic load and weather conditions
  - Information on the methodology was provided at the November and December MC/RCs
- For each simulation day, the model then draws from this distribution to determine an amount of gas that is assumed to be available for electric generation

Discussion of the Gas Constraint in the RAM IA

- The gas constraint will play an important role in cost-effectively procuring winter capacity by compensating non-firm gas capacity in a manner commensurate with its reliability contributions
- Because the optimization jointly considers this constraint and all other demand parameters when determining capacity awards, its impact on outcomes is difficult to assess in isolation
  - This is discussed at a conceptual level in the gas materials
  - We plan to unpack the impacts of the constraint in more detail in the context of the Market Clearing IA
- However, to provide stakeholders with as much information as possible, we share preliminary gas constraint MRI curves
- These curves are derived using the Near-Term Base Case

The Curves Presented Today are Preliminary

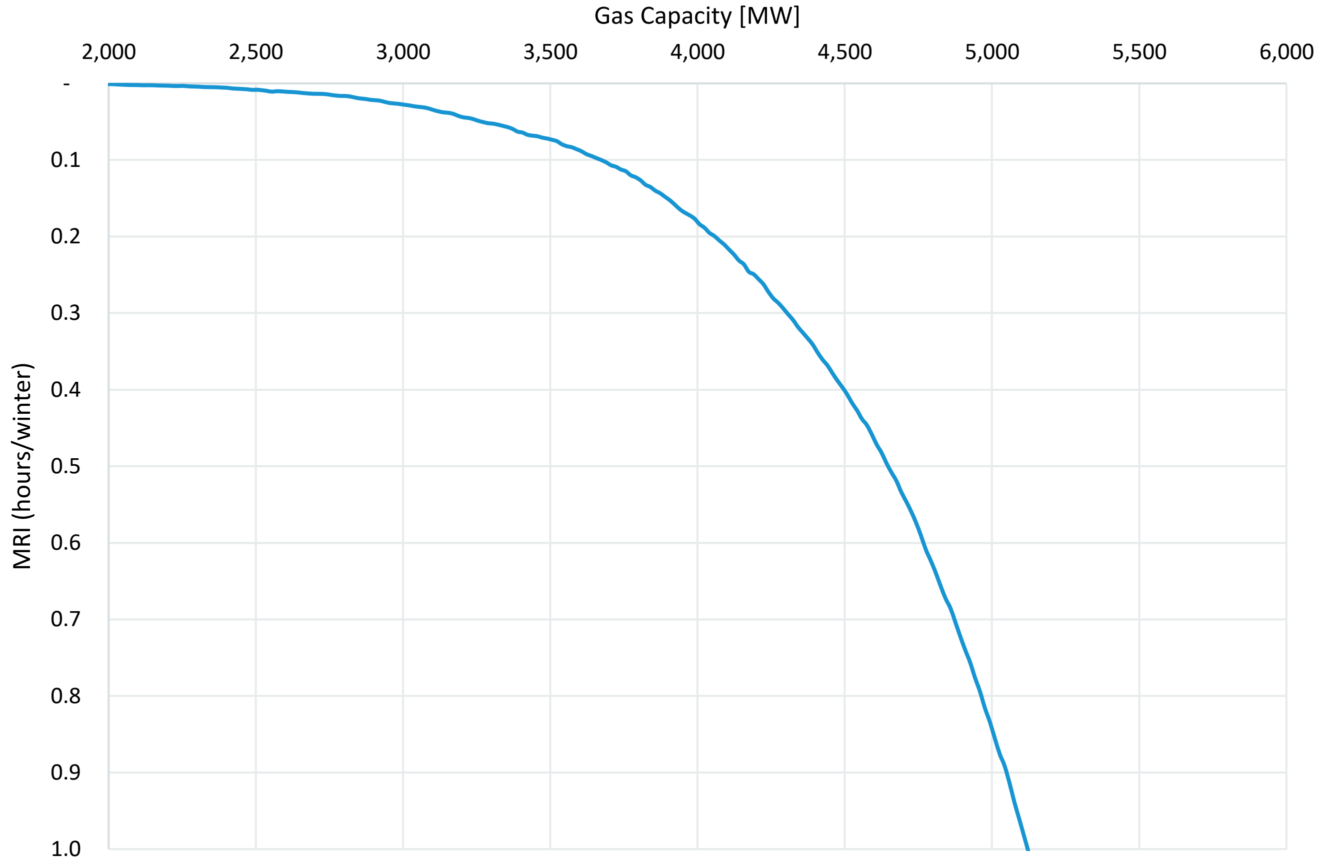
- The ISO continues to assess the methodology and profile data, including how it aligns with recent operational experience
- This gas MRI curve is derived using an updated methodology to estimate the marginal reliability impact of shifting between gas and non-gas capacity
  - More information on this methodology, which will also be employed to derive the demand curves for import and export constrained zones, will be shared at the April Reliability Committee
- The curves presented today reflect the marginal reliability contribution of gas-only generation without distinguishing between firm and non-firm resources
  - The extent to which these curves would be adjusted to more directly consider or reflect firm fuel arrangements will be discussed in the May timeframe
- The ISO will inform stakeholders of any proposed changes to the methodology regarding the profile data or calculations used to derive MRI values

MRI Gas Constraint – Preview of Results

- As with the other demand parameters, we show the gas constraint in terms of two capacity metrics: MCap and MRIC
  - The MCap curve represents a gas resource's reliability value when capacity is measured using gas resources' maximum capability
  - When expressed in terms of MRIC, the curve shifts left by ~9 percent, reflecting the fact that gas resources have an MRIC that is roughly 91 percent of their MCap, on average
  - Similar to other demand parameters, the auction will use the MRIC curve to determine capacity awards and prices
- The MCap curve suggests that:
  - Non-gas capacity provides equivalent reliability value to other resources up until the region procures ~2 GW of gas capacity (in MCap)
  - Between 2 GW and 4 GW, non-firm gas provides decreasing but still potentially substantial reliability value
  - Above 4 GW, the reliability value of non-firm gas decreases more quickly

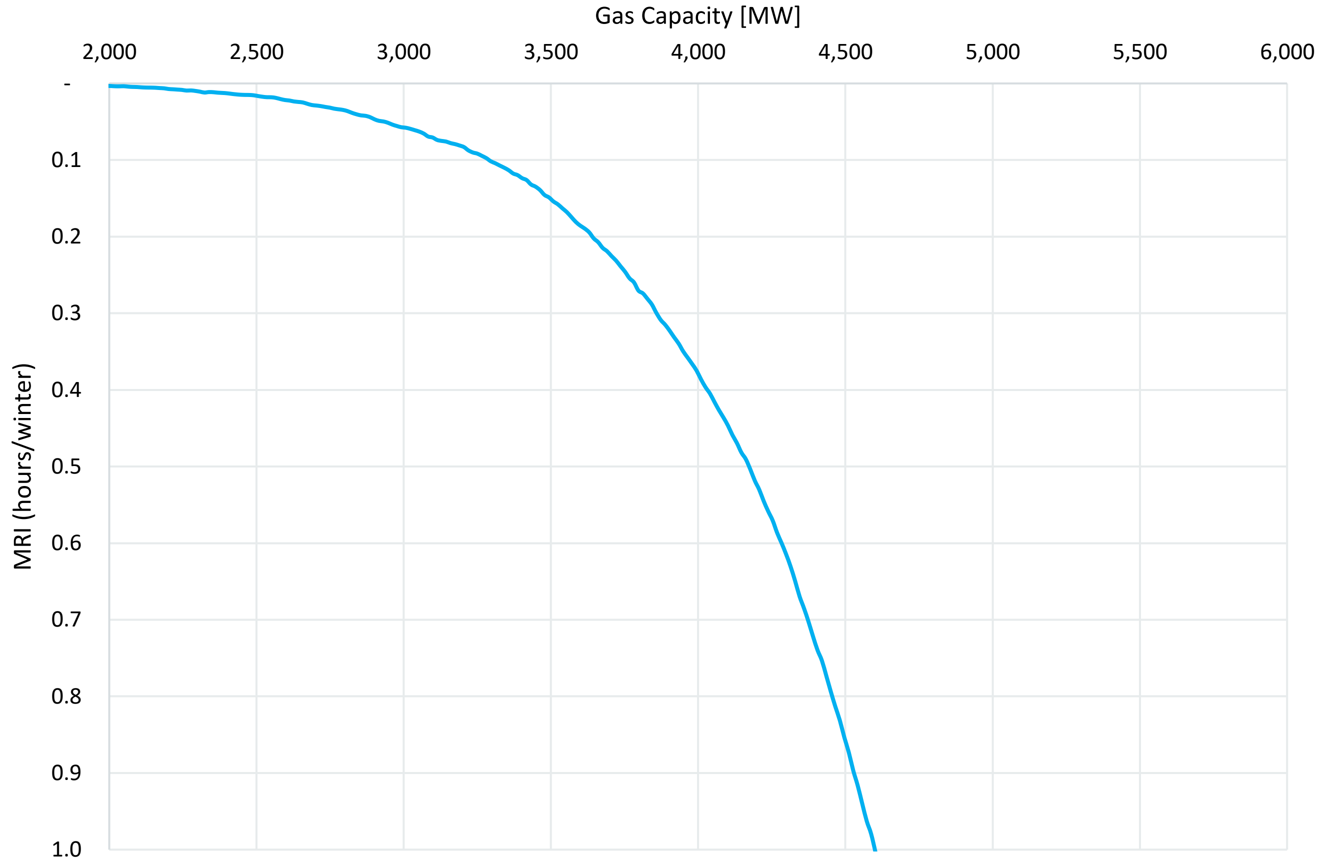
Gas Capacity MRI Curves in MCAP

- To the left of 2,000 MW, the curve is flat at an MRI of 0, indicating that non-firm gas capacity provides the same reliability value as other capacity
- As we add more non-firm capacity beyond 2 GW, its reliability value begins to diminish, indicating that there are times when there are more gas resources than gas available for electric generation and another MW of non-firm gas capacity would therefore not provide comparable reliability value to other capacity
- For context, the MRI value of winter capacity in terms of MCap when the system is at winter NICR is ~0.5 (March MC, slide 33)



Gas Capacity MRI Curves in MRIC

- The gas capacity MRI curve developed on an MCAP basis is converted to an MRIC basis using a weighted-average rMRI of 91% for all gas-only resources
- The MRI value of winter capacity when the system is at winter NICR in terms of MRIC is ~0.75 (March MC, slide 40)



SENSITIVITY AND ADDITIONAL ANALYSIS: ENERGY LIMITED AND STORAGE CHARGING/DISCHARGING LOGIC

Stakeholders requested information on expected impacts of discharge/charging orders

- The ISO has proposed to discharge energy limited (including energy storage) resources from longest-duration to shortest-duration and to charge energy storage resources from shortest-duration to longest-duration
  - See memos on energy limited and energy storage resource modeling and accreditation presented in November and December 2025
  - Note that the ISO's proposal outlined in the November and December 2025 materials was informed by analysis conducted in 2025. The analysis included in this presentation is updated to reflect model inputs, model assumptions, and the resource mix used for the IA
- Stakeholders expressed concern that the proposed discharging/charging order may undervalue the reliability contributions of some energy storage resources and have requested additional analysis on the expected impacts of different discharging and charging configurations

Information Outline - Expected Impacts of Discharge/Charging Orders

- The next slides provide:
  - Descriptions of the different discharging and charging configurations the ISO tested
  - Summary expected impacts on reliability metrics (LOLE/EUE) of the choice of different configuration
  - Plots of rMRI duration curves for tested scenarios
  - Summary of expected impacts on reliability metrics (LOLE/EUE) and plots of rMRI duration curves for a sensitivity of 2 GW of additional 4-hour energy storage resources

ISO tested seven different discharging/charging configurations

Scenario	Discharge	Charge
ISO Proposed Logic	Longest to Shortest Duration	Shortest to Longest Duration
Scenario 1	Longest to Shortest Duration	Longest to Shortest Duration
Scenario 2	Longest to Shortest Duration	Proportional
Scenario 3	Shortest to Longest Duration	Shortest to Longest Duration
Scenario 4	Shortest to Longest Duration	Longest to Shortest Duration
Scenario 5	Shortest to Longest Duration	Proportional
Scenario 6	Proportional	Proportional

Preview of Key Takeaways

- Any tested discharge order other than longest-to-shortest duration results in an inefficient use of the system's limited energy and a significant increase in modeled reliability risk
- As such, the ISO plans to continue to implement longest-to-shortest discharge
- Conditional on longest-to-shortest discharge, different charging logics yield comparable results
- For almost all durations and configurations, the ISO's proposed configuration yields comparable or higher rMRI values for energy storage resources
- Results do not change significantly with 2 GW of additional 4-hour energy storage capacity added to the resource mix
- The ISO requests stakeholder feedback on the choice of configuration
- **Next:** estimated impacts on resource adequacy metrics

ISO compared resource adequacy metrics across configurations

- Design objective is to select a discharging/charging configuration that efficiently utilizes the system's limited energy
  - This prevents the resource adequacy model from incorporating unnecessary risk and helps to prevent an overly conservative resource adequacy model
- To compare how efficiently the different configurations utilize the system's limited energy, the ISO:
  - Brought the system to the 0.05 loss of load expectation (LOLE) criterion in each season with the ISO's proposed configuration (longest to shortest discharge, shortest to longest charge)
  - Holding all else constant, changed the discharging/charging configuration to one of the other configurations and measured the impact on LOLE and expected unserved energy (EUE)
- **Next:** a table that summarizes expected impacts on reliability metrics

Shortest-to-longest duration discharge inefficiently utilizes the system's limited energy

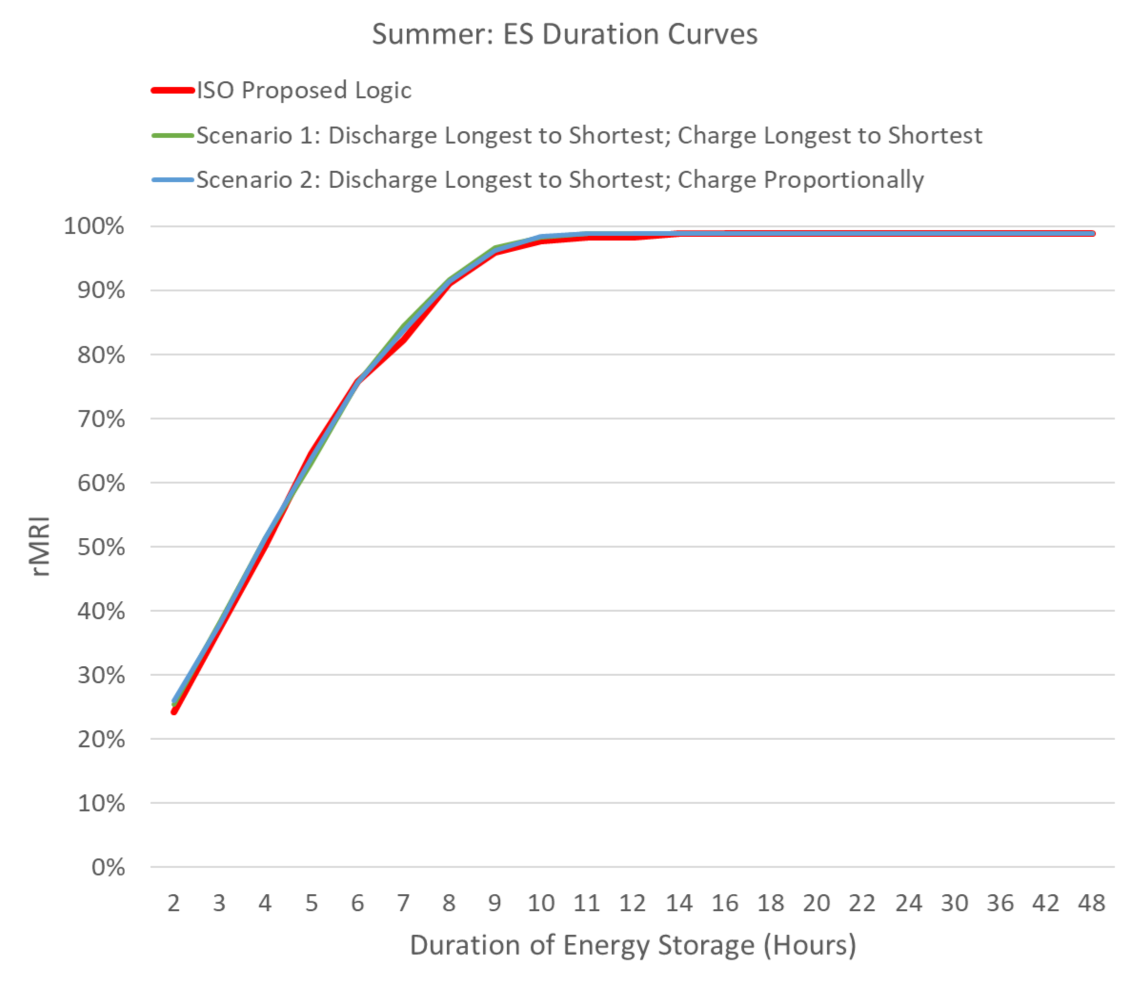
	Dispatch	Charge	Summer LOLE	Summer EUE	Winter LOLE	Winter EUE
ISO Proposed Logic	Long to Short	Short to Long	0.05	147.5	0.05	324.8
Scenario 1	Long to Short	Long to Short	0.05	143.9	0.05	323.0
Scenario 2	Long to Short	Proportional	0.05	144.2	0.05	343.7
Scenario 3	Short to Long	Long to Short	0.18	429.1	0.14	588.6
Scenario 4	Short to Long	Short to Long	0.18	430.5	0.14	628.1
Scenario 5	Short to Long	Proportional	0.19	441.0	0.14	597.0
Scenario 6	Proportional	Proportional	0.10	272.4	0.08	456.9

- Configurations that discharge resources from longest-to-shortest duration yield similar reliability metrics
- Any configuration that does not discharge resources from longest-to-shortest duration significantly increases LOLE and EUE

Key Takeaways

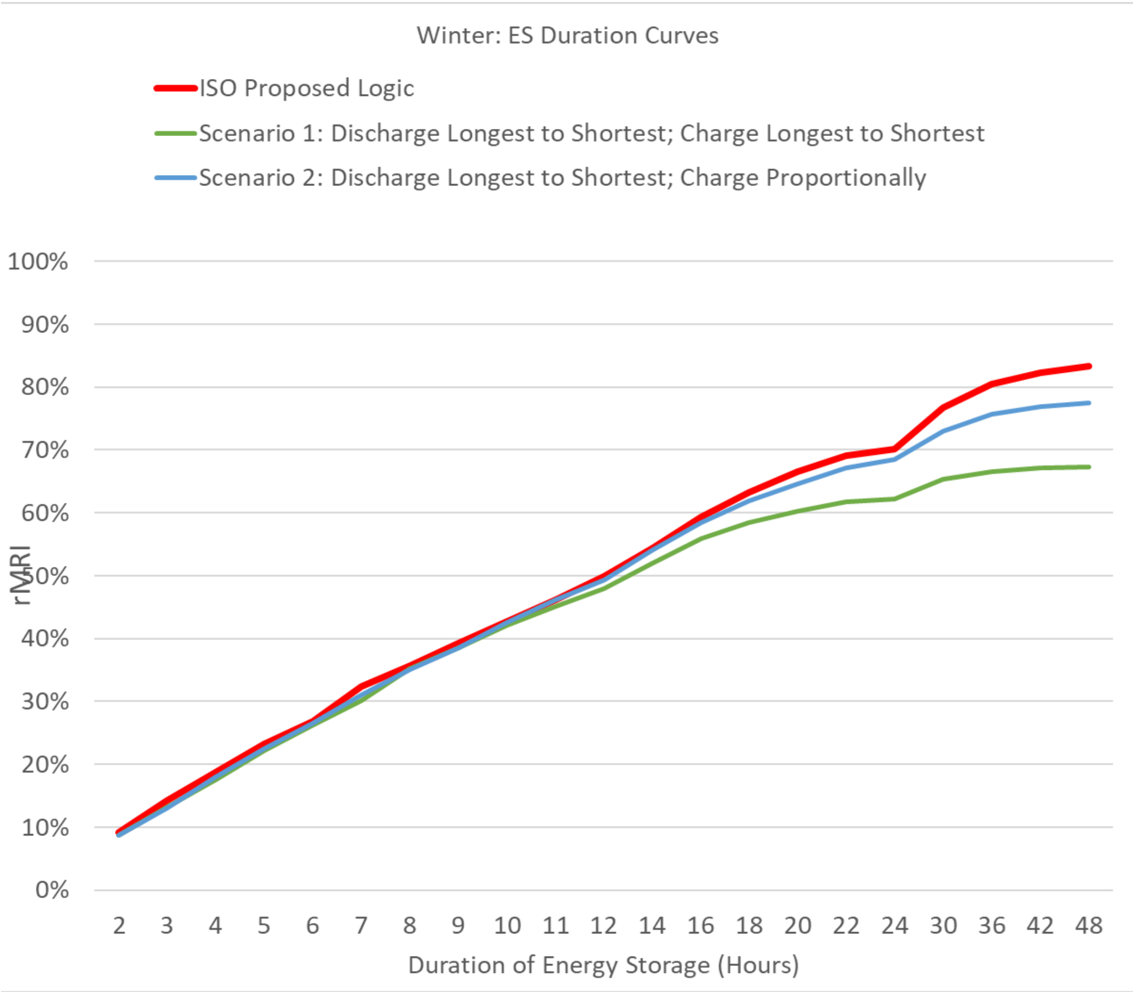
- Any discharging/charging configuration that does not discharge resources from longest-to-shortest duration inefficiently uses the system's limited energy and significantly increases modeled reliability risk
- As a result, the ISO is planning to pursue a longest-to-shortest discharge configuration
- Conditional on discharging energy limited resources from longest-to-shortest duration, different charging configurations yield similar reliability metrics and so are comparable in terms of the efficient use of the system's limited energy
- **Next:** a plot of the summer rMRI duration curves for ISO Proposed Logic and Scenarios 1 and 2

Comparison of long-to-short discharge configurations in summer



- Estimated summer rMRIs for proxy energy storage resources with different durations, by discharging/charging configuration
  - Assumed 0 % forced outage rate (EFORd)
- rMRI values are comparable across configurations, with some small differences
- **Next:** a plot of the winter rMRI duration curves for ISO Proposed Logic and Scenarios 1 and 2

Comparison of long-to-short discharge configurations in winter



- Estimated winter rMRI for proxy energy storage resources with different durations, by discharging/charging configuration
  - Assumed 0 % forced outage rate (EFORd)
- Winter rMRI values generally comparable or higher with ISO's proposed configuration

Appendix A includes additional comparisons

- Appendix A includes figures that compare rMRI duration curves for the ISO's proposed logic with configurations that do not discharge energy limited resources from longest-to-shortest duration
- ISO's proposed configuration yields energy storage rMRI values that are comparable or higher than other configurations for almost all durations

Key Takeaways

- ISO's proposed configuration (discharge resources from longest-to-shortest duration and charge resources from shortest-to-longest duration) yields energy storage rMRI values that are comparable or higher than other configurations
- ISO believes that the ISO's proposed logic and Scenarios 1 and 2 would all be reasonable and welcomes stakeholder feedback on which configuration to pursue for CAR
- **Next:** comparisons of ISO's proposed configuration and Scenarios 1 and 2 with an additional 2 GW of energy storage resources

Requested stakeholder sensitivity: 2 GW of additional 4-hour energy storage resources

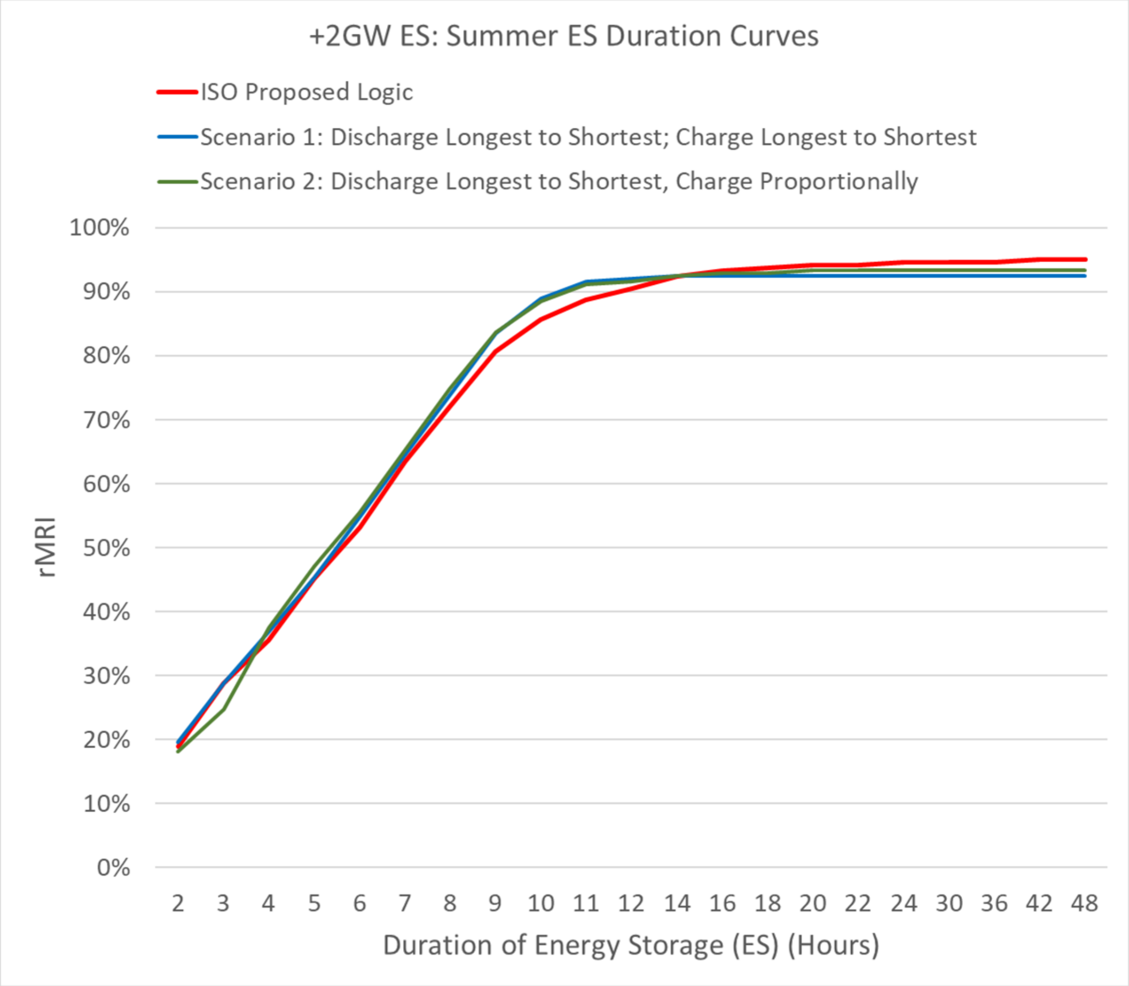
- As a sensitivity, stakeholders requested an examination of the expected impact of discharging/charging configuration on reliability metrics and rMRI values when an additional 2 GW of 4-hour energy storage resources in the mix, holding all else constant
- **Next:** a comparison of reliability metrics across ISO's proposed configuration and Scenarios 1 and 2 with the added 4-hour batteries

Long-to-short discharge configurations yield comparable reliability metrics, 2 GW ES added

			Summer		Winter	
	Dispatch	Charge	LOLE	EUE	LOLE	EUE
ISO Proposed Logic	Long to Short	Short to Long	0.05	189.0	0.05	422.2
Scenario 1	Long to Short	Long to Short	0.05	177.0	0.05	425.4
Scenario 2	Long to Short	Proportional	0.05	184.7	0.05	423.4

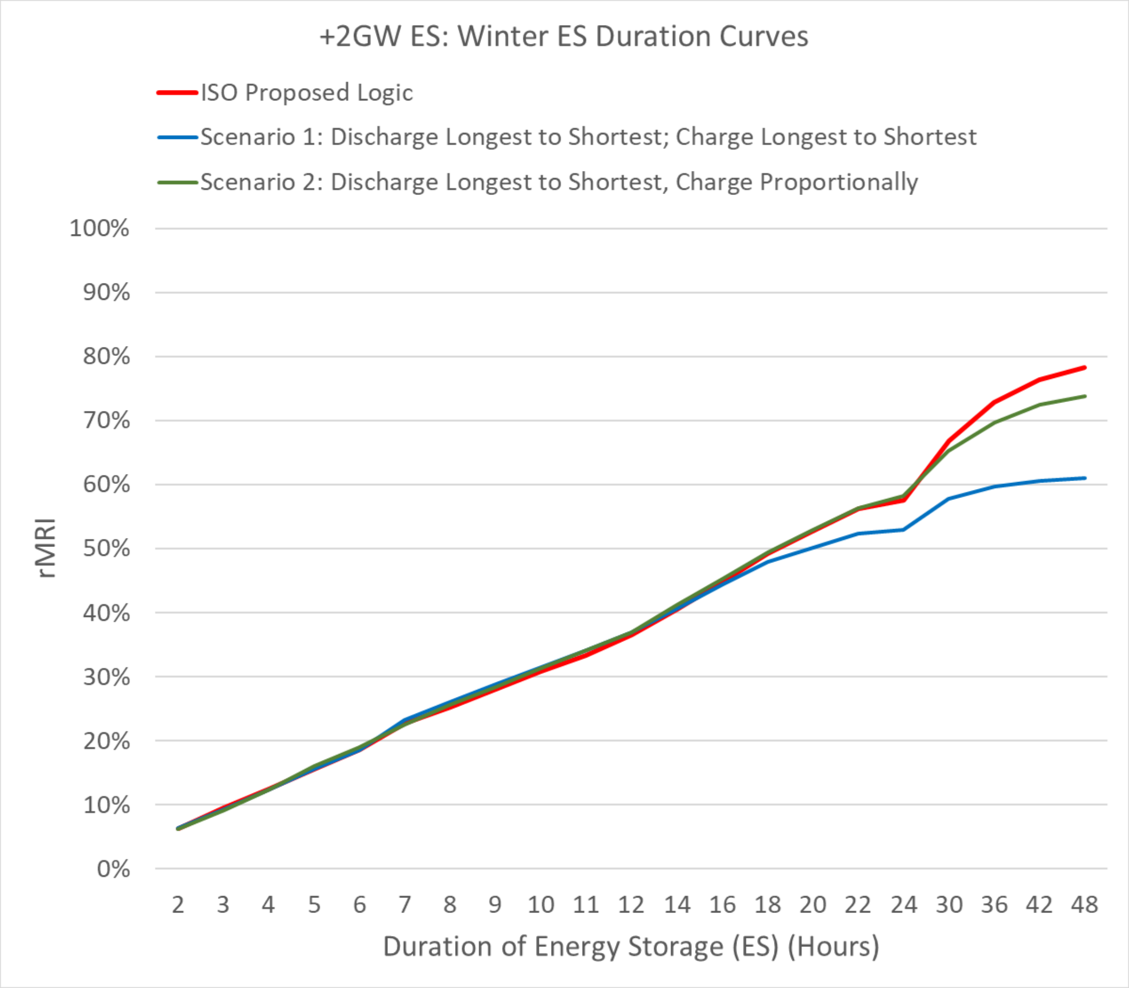
- To compare how efficiently the different configurations utilize the system's limited energy, the ISO:
  - Brought the system to the 0.05 loss of load expectation (LOLE) criterion in each season with the ISO's proposed logic
  - Holding all else constant, changed the discharging/charging configuration to one of the other configurations and measured the impact on LOLE and EUE

Comparison of long-to-short discharge configurations in summer, 2 GW ES added



- Estimated summer rMRI for proxy energy storage resources with different durations, by discharging/charging configuration
  - Assumed 0 % forced outage rate (EFORd)
- As before, rMRI values are comparable across configurations, with some small differences
- **Next:** comparison of winter rMRIs for long-to-short discharge configurations with 2 GW of additional 4-hour energy storage resources

Comparison of long-to-short discharge configurations in winter, 2 GW ES added



- Estimated winter rMRI for proxy energy storage resources with different durations, discharging/charging configuration
  - Assumed 0 % forced outage rate (EFORd)
- As before, winter rMRI values generally comparable or higher with ISO's proposed configuration

Key Takeaways

- The addition of 2 GW of 4-hour batteries reduces the rMRI values of energy storage resources across all long-to-short discharging configurations
- However, rMRIs by duration do not vary significantly across long-to-short discharging configurations
- Reliability metrics are comparable across long-to-short discharging configurations

SENSITIVITY AND ADDITIONAL ANALYSIS: ADJUSTING THE SEASONAL RISK SPLIT TO 80/20 SUMMER/WINTER

Background: ISO's Proposal Uses an Even LOLE Split

- The ISO's proposal sets the seasonal LOLE criteria at equal 0.05 values
- These are reflected in the seasonal NICR values and represent the cases from which resource accreditation values are derived
- The ISO provided more information on this proposal at the December Markets Committee
  - Explained that while the seasonal NICR values depend directly on the seasonal split, capacity demand curves are derived from capacity's MRI value, which does not depend on the seasonal split
- Next: Discuss modeled 80/20 LOLE split further

Evaluation of Alternative LOLE Splits

- Stakeholders have inquired about the impacts of alternative risk splits on reliability and market outcomes
- In the RAM IA input form, there was considerable interest in evaluating the impact of an alternative risk split that uses an 80/20 LOLE split to determine the seasonal criteria values
- This would effectively reduce the summer NICR to reflect the capacity level that corresponds with 0.08 LOLE (rather than 0.05)
  - The opposite effect occurs in the winter, where the stricter criteria increases the winter NICR
- In the following slides, we share results on key reliability outputs (seasonal NICRs, LOLE and EUE values at these NICRs) and then evaluate the impact of this change on resource accreditation values
  - Additional results provided in Appendix B

Alternative LOLE Split: Preview of Results

- With the 80/20 LOLE split, the summer Net ICR decreases and the winter value increases compared to 50/50
- However, the accreditation values by resource type appear quite similar to those observed with a 50/50 LOLE split
- Rationale for limited winter change to accreditation values: While the number of events at the criterion value decreases, there are two impacts that are largely offsetting:
  - Shorter events from the 50/50 case are no longer observed; this would tend to increase the average event duration and <u>decrease</u> the accreditation of energy limited and storage resources
  - The remaining events that still occur in the 80/20 split tend to become shorter in duration; this will tend to decrease the average event duration and <u>increase</u> the accreditation of energy limited and storage resources

Net ICR and Reliability Metrics

	Summer		Winter	
	50/50 split	80/20 split	50/50 split	80/20 split
Net ICR (MW in MCap)	32,016	31,708	28,620	29,217
LOLE (days/season)	0.05	0.08	0.05	0.02
LOLH (hours/season)	0.16	0.27	0.28	0.11
EUE (MWh/season)	147	251	324	121
50/50 Peak (MW)	25,124		21,101	

- When compared to 50/50 LOLE split, under an 80/20 seasonal split:
    - Summer Net ICR decreases, resulting in an increase in the number of days and hours with resource adequacy risks and a corresponding rise in expected unserved energy
    - Conversely, winter Net ICR increases, leading to fewer days and hours with resource adequacy risks and a reduction in expected unserved energy

Detailed Net ICR Calculation

- Detailed Net ICR calculation for Near-Term Base Case under 50/50 and 80/20 split

	Summer MCap (MW)		Winter MCap (MW)	
	50/50	80/20	50/50	80/20
Generating Capacity Resources	34,072	34,072	35,661	35,661
Active Demand Capacity Resources	794	794	674	674
Passive Demand Resources	N/A	N/A	N/A	N/A
Import Capacity Resources	2,205	2,205	1,331	1,331
Total System Resources	**37,070**	**37,070**	**37,667**	**37,667**
Peak Load	25,124	25,124	21,101	21,101
ALCC (%)	15.78%	16.91%	31.6%	28.92%
ALCC (MW)	**3,967**	**4,248**	**6,670**	**6,102**
Net ICR	**32,016**	**31,708**	**28,620**	**29,217**

$$Net\ ICR = \frac{Total\ Current\ Capacity}{1 + \frac{ALCC}{Peak\ Load}}$$

Discussion: Net ICR and Reliability Metrics

- When comparing a 50/50 split to an 80/20 split:
  - Summer NICR decreases by ~300 MW
  - Winter NICR increases by ~600 MW
- Winter increase is greater than summer decrease because the LOLE curves are convex and decreasing
  - Requires more capacity to improve reliability from 0.05 LOLE to 0.02 LOLE than from 0.08 to 0.05
- While the number of events at NICR increases in the summer and decreases in the winter, the average duration and EUE per event remains largely unchanged in each season
  - Can be seen by dividing the LOLH or EUE by the columns corresponding LOLE

Change in Event Properties/Durations with 80/20 Split

- Comparing a 50/50 to 80/20 LOLE split shows a reduction in winter events, with most of the eliminated events being shorter duration
- This means that the remaining events tend to be those that were longer in duration to begin with, though this duration decreases somewhat to reflect the assumed additional capacity
- Taken together, this results in a similar distribution of event durations between the 50/50 and 80/20 LOLE splits
- Next: Unpack each of these in more detail

Winter MRI Event Obs. (50/50 vs. 80/20 split), cont.

- The tables below illustrate how MRI events change between the 50/50 to the 80/20 scenario
- As additional resources are added to the system, a significant number of MRI events across all durations are either eliminated or shortened, with the total number of events declining from 5,003 to 2,105
- The events that are fully eliminated are primarily shorter-duration events, while longer-duration events tend to persist but with reduced durations. As a result, these longer events carry greater weight within the remaining event population
- Consequently, the overall distribution of event durations under the 80/20 scenario remains broadly similar to that observed under the 50/50 scenario

				80/20 MRI Events							
				%		5%	41%	16%	25%	13%	100%
				MRI hours		0.02	0.13	0.05	0.08	0.04	0.32
				Count		339	1142	257	272	95	2105
50/50 MRI Events	%	MRI hours	Count	MRI Event Duration	0	1-12h	13-24h	25-36h	36-48h	>48h	Total
	5%	0.04	774	1-12h	649	125	0	0	0	0	774
	41%	0.34	2765	13-24h	1878	113	774	0	0	0	2765
	17%	0.14	583	25-36h	229	75	162	117	0	0	583
	25%	0.21	677	36-48h	138	21	188	110	220	0	677
	11%	0.09	204	>48h	4	5	18	30	52	95	204
	100%	0.82	5003	Total	2898	339	1142	257	272	95	5003

MRI Event Duration	Counts under 50/50	Count Eliminated	%
1-12h	774	649	84%
13-24h	2765	1878	68%
25-36h	583	229	39%
36-48h	677	138	20%
>48h	204	4	2%
Total	5003	2898	58%

Winter MRI Event Obs. (50/50 vs. 80/20 split)

- Under the 50/50 split, the majority of resource adequacy risk is concentrated in the top five winter peak weather years, with particularly elevated risk in years characterized by consecutive cold days, such as 2003/04 and 2002/03
- Under the 80/20 split, resource adequacy risk becomes even more concentrated in these same years, with winters featuring consecutive cold days accounting for an even larger share of the risk

	50/50 Split					80/20 Split				
MRI Event Duration	2003/04	2018/19	2002/03	2006/07	2004/05	2003/04	2018/19	2002/03	2006/07	2004/05
6	0.003	0.003	0.002	0.000	0.000	0.002	0.001	0.001	0	0.000
7	0.006	0.002	0.004	0.001	0.001	0.004	0.001	0.001	0.000	0.000
8	0.003	0.002	0.002	0.000	0.001	0.001	0.001	0.001	0	0.000
9	0.002	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0	0
13	0.000	0.006	0.001	0.000	0.001	0.000	0.003	0.001	0	0.000
14	0.003	0.013	0.004	0.000	0.002	0.001	0.008	0.000	0.000	0.000
15	0.014	0.033	0.016	0.003	0.008	0.009	0.014	0.004	0.001	0.002
16	0.034	0.007	0.036	0.005	0.010	0.017	0.002	0.012	0.001	0.003
17	0.029	0.004	0.021	0.004	0.004	0.016	0.002	0.008	0.002	0.001
18	0.008	0	0.005	0.001	0.001	0.004	0.000	0.003	0.000	0.000
27	0.005	0	0.001	0	0	0.002	0	0	0	0
28	0.009	0	0.001	0	0.00	0.005	0	0	0	0.000
29	0.014	0	0.001	0	0.00	0.008	0	0	0	0.001
30	0.016	0	0.009	0	0.00	0.008	0	0.001	0.000	0.001
31	0.011	0.000	0.020	0	0.00	0.005	0	0.005	0.001	0.001
32	0.003	0.000	0.005	0	0.00	0.002	0	0	0	0.000
38	0.015	0.002	0.002	0	0.00	0.008	0.000	0.002	0	0.001
39	0.035	0.004	0.019	0.000	0.01	0.016	0.001	0.009	0.000	0.001
40	0.028	0.002	0.018	0	0.00	0.011	0.001	0.008	0	0.001
41	0.014	0.000	0.014	0.000	0.00	0.004	0.000	0.004	0	0
42	0.004	0.000	0.005	0	0.00	0.001	0	0	0	0
54	0.004	0	0.001	0	0	0.003	0	0	0	0
55	0.004	0	0.003	0	0.000	0.002	0	0.001	0	0.000
63	0.014	0	0.002	0	0	0.006	0	0	0	0
64	0.011	0	0.006	0	0.001	0.005	0	0.002	0	0
65	0.003	0	0.003	0	0	0.000	0	0.002	0	0
Total MRI hours	**0.32**	**0.08**	**0.21**	**0.02**	**0.06**	**0.16**	**0.04**	**0.07**	**0.01**	**0.01**
% of total MRI hours	**40%**	**10%**	**25%**	**2%**	**7%**	**49%**	**12%**	**21%**	**2%**	**4%**

Winter MRI Events Obs. (50/50 vs. 80/20 split), cont.

- This table compares the expected hours associated with major MRI event durations and their corresponding percentages under both the 50/50 and 80/20 splits
  - Included are event durations with contributions greater than 0.5%, drawn from all weather years
- The relative weighting across event durations is largely consistent between the two scenarios

	MRI hours		%	
MRI Event Duration	50/50	80/20	50/50	80/20
6	0.0091	0.0040	1.1%	1.2%
7	0.0150	0.0068	1.8%	2.1%
8	0.0095	0.0035	1.2%	1.1%
9	0.0039	0.0016	0.5%	0.5%
13	0.0081	0.0051	1.0%	1.6%
14	0.0295	0.0114	3.6%	3.6%
15	0.0862	0.0324	10.5%	10.1%
16	0.1146	0.0429	14.0%	13.4%
17	0.0730	0.0323	8.9%	10.1%
18	0.0201	0.0087	2.4%	2.7%
19	0.0045	0.0023	0.5%	0.7%
27	0.0083	0.0024	1.0%	0.7%
28	0.0125	0.0051	1.5%	1.6%
29	0.0231	0.0088	2.8%	2.7%
30	0.0368	0.0115	4.5%	3.6%
31	0.0403	0.0132	4.9%	4.1%
32	0.0116	0.0027	1.4%	0.9%
37	0.0057	0.0045	0.7%	1.4%
38	0.0248	0.0146	3.0%	4.5%
39	0.0736	0.0281	9.0%	8.8%
40	0.0548	0.0219	6.7%	6.8%
41	0.0335	0.0090	4.1%	2.8%
42	0.0104	0.0023	1.3%	0.7%
54	0.0077	0.0061	0.9%	1.9%
55	0.0080	0.0039	1.0%	1.2%
56	0.0047	0.0010	0.6%	0.3%
61	0.0048	0.0014	0.6%	0.4%
62	0.0044	0.0024	0.5%	0.7%
63	0.0161	0.0074	2.0%	2.3%
64	0.0186	0.0071	2.3%	2.2%
65	0.0077	0.0020	0.9%	0.6%

rMRI Values Under an 80/20 LOLE Split

- The number of expected events decreases by ~60% with decrease from 0.05 to 0.02 LOLE in the at criterion winter case
- However, because the duration of these winter events tends to be similar, this results in rMRI values that also tend to be comparable across the various resource types in the winter
- Similarly, the summer rMRI values tend to be comparable with the 80/20 LOLE split
- Next: Walk through these rMRI values by resource type

Summary of rMRI for Thermal Modeled Resources

	MCap (MW)		rMRI based on 50/50 Split		rMRI based on 80/20 Split	
	Summer	Winter	Summer	Winter	Summer	Winter
Gas-only	8,006	8,637	91.9%	91.0%	92.4% (+0.5%)	90.5% (-0.5%)
Oil/Dual-Fuel (Thermal)	10,516	11,287	82.1%	79.3%	82.9% (+0.8%)	77.8% (-1.5%)
Daily/Weekly Hydro	1,067	1,060	95.0%	96.2%	95.1% (+0.1%)	96.0% (-0.2%)
Other Thermal (including Nuclear)	3,947	3,968	86.9%	88.7%	87.7% (+0.8%)	86.8% (-1.9%)
Imports	2,205	1,331	91.5%	88.4%	91.7% (+0.2%)	87.8% (-0.6%)

- The 80/20 split does not result in material changes to thermal resource rMRI values compared with the 50/50 split

Summary of rMRI for Energy Limited and Storage Resources

	MCap (MW)		rMRI based on 50/50 Split		rMRI based on 80/20 Split	
	Summer	Winter	Summer	Winter	Summer	Winter
Oil/Dual-Fuel (EL3)	840	1,019	90.9%	67.2%	91.0% (+0.1%)	67.0% (-0.2%)
Energy Storage Resources (PSH + Batteries)	3,877	3,875	55.2%	20.9%	55.3% (+0.1%)	21.4% (+0.5%)
Hybrid (PV/ES + Hydro/ES)	1,053	1,053	50.8%	25.2%	50.8% (0%)	25.4% (+0.2%)

- There are no material changes in the rMRI values for Energy Limited and Storage Resources under the 80/20 split compared to the 50/50 split

Summary of rMRI for Profile Resources

	MCap (MW)		rMRI based on 50/50 Split		rMRI based on 80/20 Split	
	Summer	Winter	Summer	Winter	Summer	Winter
IPR - Wind	2,525	2,525	19.9%	36.1%	20.4% (+0.5%)	34.0% (-2.1%)
IPR - Solar	1,409	1,409	24.1%	7.1%	24.2% (+0.1%)	7.1% (0%)
IPR - Hydro	560	560	40.7%	59.9%	40.9% (+0.2%)	59.2% (-0.7%)
IPR - Others	273	273	79.8%	79.2%	79.9% (+0.1%)	78.8% (-0.4%)
ADCR	794	674	22.5%	34.3%	22.8% (+0.3%)	34.6% (+0.3%)
PDR	6,504	6,186	53.1%	58.7%	52.9% (-0.2%)	58.9% (+0.2%)

- rMRI values for profiles resources are almost identical under 80/20 and 50/50 splits

FUTURE CASE RESULTS

Future Cases Results

- To provide additional information on potential results, the ISO has run the model under three future cases
- Assumptions for these cases regarding the assumed resource mix and load profiles were developed in coordination with stakeholders
- These cases seek to provide information about how demand parameters and accreditation value could change in the future as the system evolves, but are not intended to serve a predictions of future outcomes
- *Next*: Walk through the assumptions for all the cases and then the results, starting with Future Case 1, where the results were shared but not discussed in March due to time constraints

Future Cases: Detailed Resource Mix Breakdown

- Resource mix comparison between Near-Term Base Cas, Future Case 1, Future Case 2 and Future Case 3
  - Incremental capacity additions for all future cases are incremental to Near-Term Base Case
- Resource mix assumptions for each case were developed in coordination with stakeholders

		Summer Capacity				Capacity Additions from Near-Term		
		Near-Term Base Case	Future Case 1	Future Case 2	Future Case 3	Future Case 1	Future Case 2	Future Case 3
Thermal	Gas-only	8,006	8,006	8,006	8,006	-	-	-
	Oil/Dual-Fuel (includes energy limited)	11,356	11,356	11,356	11,356	-	-	-
	Daily/Weekly Hydro	1,067	1,067	1,067	1,067	-	-	-
	Other Thermal (including Nuclear)	3,947	3,947	3,947	3,947	-	-	-
	Imports	2,205	2,205	2,205	2,205	-	-	-
IPRs	Land-Based Wind	992	992	1,492	8,992	-	500	8,000
	Offshore Wind	1,533	3,533	4,533	7,533	2,000	3,000	6,000
	IPR - Solar	1,409	1,609	2,109	11,809	200	700	10,400
	IPR - Hydro	560	560	560	560	-	-	-
	IPR - Others	273	273	273	273	-	-	-
Storage	PSH	1,873	1,873	1,873	1,873	-	-	-
	Short Duration Storage (<4 Hours)	593	793	793	793	200	200	200
	Medium Duration BESS (4-10 Hours)	1,411	1,411	2,111	2,711	-	700	1,300
	Long Duration Storage (10-24 Hours)	-	-	-	750	-	-	750
	Multi-Day Storage (24+ Hours)	-	-	-	750	-	-	750
Other	Hybrid (PV/ES + Hydro/ES)	1,053	1,053	1,053	1,053	-	-	-
	ADCR	794	794	794	794	-	-	-
Totals	Thermal	26,580	26,580	26,580	26,580	-	-	-
	IPRs	4,767	6,967	8,967	29,167	2,200	4,200	24,400
	Storage	3,877	4,077	4,777	6,877	200	900	3,000
	Other	1,846	1,846	1,846	1,846	-	-	-
	System	37,070	39,470	42,170	64,470	2,400	5,100	27,400

Future Cases: Load Assumptions

- Future Cases 1 and 2 begin with the 2035 Load Forecast from the 2025 CELT
  - Winter load forecast scaled down by 5% to balance supply and demand for both cases
- Future Case 3 begins with the 2040 Load Forecast from the 2025 CELT
  - Winter load forecast scaled down by 10% to balance supply and demand
- Load assumptions were also developed in close coordination with stakeholders

FUTURE CASE 1

Future Case 1: Preview of Results

- Net ICR values increase substantially from Near-Term Base Case, especially in the winter to reflect projected load growth
- Most class accreditation values remain similar to Near-Term Base Case values in both seasons
  - Thermal resources generally see slightly higher rMRI values
  - Storage resources see an increase in their summer rMRI value
- Wind and solar see decreases in their average seasonal rMRI values as compared to the Near-Term Base Case, reflecting the fact that as more such resources are assumed, reliability events are more likely to occur during periods of when they perform comparatively poorly
  - In other words, when we add more wind, reliability events are more likely to occur when wind resources are providing relatively less power
  - Load profile assuming continued behind-the-meter solar growth factors into this as well

Future Case 1 Net ICR

- This table summarizes system capacity and load, Net ICR expressed in both MCap and MRIC terms, and key reliability metrics for the near-term base case and Future Case 1
- Net ICR increases in both summer and winter, driven by the higher 2035 load forecast
- Winter NICR experiences a greater increase, reflecting larger projected load growth in that season
- Winter EUE rises substantially, likely due to changes in load characteristics with higher electrification assumptions in the 2035 forecast and resource mix with a higher level of intermittent resources

	Summer		Winter	
	Near-Term Base Case	Future Case 1	Near-Term Base Case	Future Case 1
Seasonal MCap (MW)	37,070	39,470 (+2,400)	37,667	40,067 (+2,400)
50/50 Net Peak (MW)	25,124	27,331 (+2,207)	21,101	25,908 (+4,807)
ALCC in %	15.8%	7.8% (-8.0%)	31.6%	4.1% (-27.5%)
Net ICR in MCap (MW)	32,016	36,625 (+4,609)	28,620	38,493 (+9,873)
LOLE (days/season)	0.05	0.05 (+0.00)	0.05	0.05 (-0.00)
LOLH (hours/season)	0.16	0.16 (-0.01)	0.28	0.29 (+0.02)
EUE (MWh/season)	147	135 (-12)	325	530 (+205)
System MRIC (MW)	27,362	27,874 (+512)	26,083	27,273 (+1,190)
Net ICR in MRIC (MW)	23,631	25,864 (+2,233)	19,819	26,202 (+6,383)
System rMRI	73.8%	70.6% (-3.2%)	69.2%	68.1% (-1.2%)

Future Case 1 Summer rMRI for Thermal Modeled Resources

- The summer rMRI values of these resources under the Future Case 1 are very similar to the near-term CCP 19 Base Case
  - Each class sees a slight increase in its average rMRI
  - MCap and EFORd values are the same for these two cases

	Summer MCap		Summer rMRI	
Resource Class	**Base Case**	**Future Case 1**	**Base Case**	**Future Case 1**
Gas-only	8,006	8,006 (0)	91.9%	92.4% (+0.5%)
Oil/Dual-Fuel (Thermal)	10,516	10,516 (0)	82.1%	83.4% (+1.3%)
Daily/Weekly Hydro	1,067	1,067 (0)	95.0%	95.4% (+0.4%)
Other Thermal (including Nuclear)	3,947	3,947 (0)	86.9%	88.0% (+1.1%)
Imports	2,205	2,205 (0)	91.5%	92.4% (+0.9%)

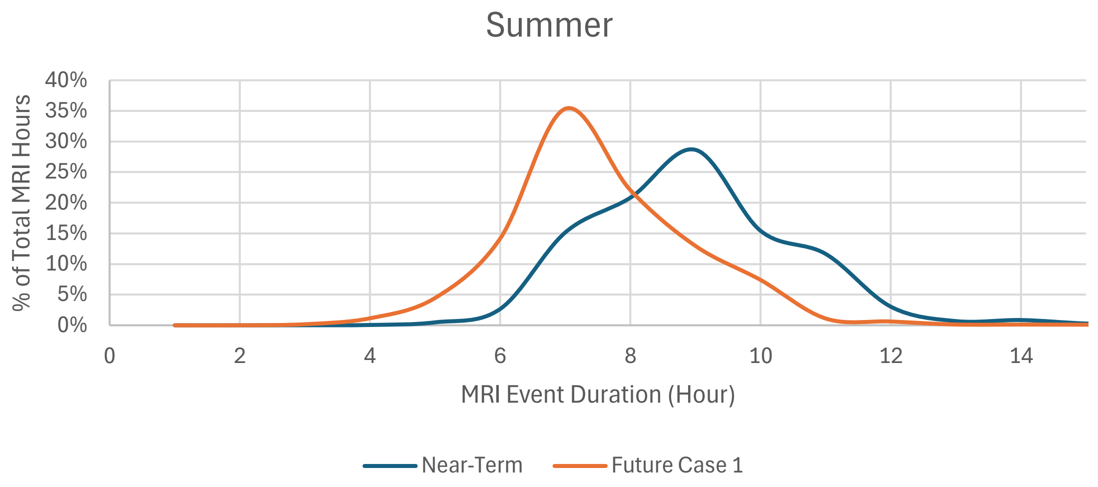
Future Case 1 Winter rMRI for Thermal Modeled Resources

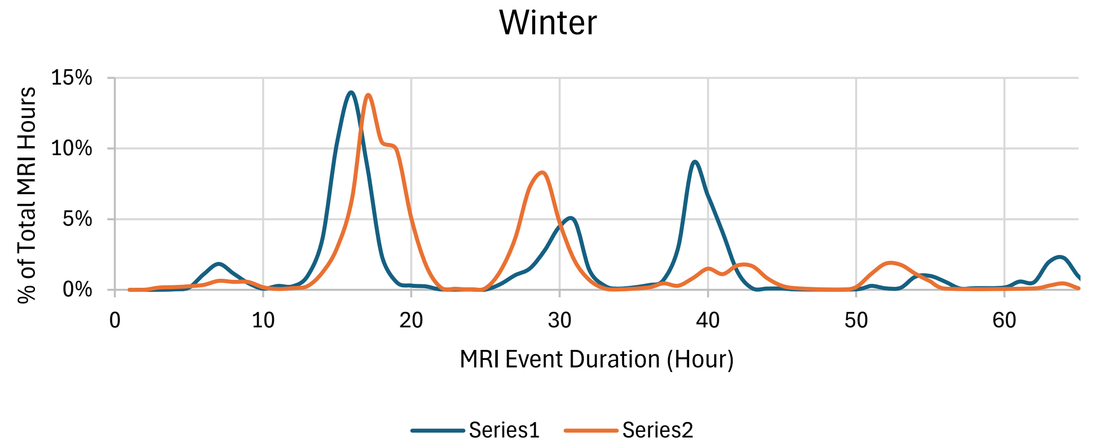
- The winter rMRI values of these resources under the Future Case 1 are slightly increased to the near-term CCP 19 Base Case
  - Class average increases range from 0.02% to 3.8%
  - MCap and EFORd values are the same for these two cases

	Winter MCap		Winter rMRI	
Resource Class	**Base Case**	**Future Case 1**	**Base Case**	**Future Case 1**
Gas-only	8,637	8,637 (0)	91.0%	92.4% (+1.4%)
Oil/Dual-Fuel (Thermal)	11,287	11,287 (0)	79.3%	83.1% (+3.8%)
Daily/Weekly Hydro	1,060	1,060 (0)	96.2%	96.4% (+0.2%)
Other Thermal (including Nuclear)	3,968	3,968 (0)	88.7%	91.5% (+2.8%)
Imports	1,331	1,331 (0)	88.4%	89.2% (+0.8%)

MRI Event Duration Distribution Comparison

- Compared to the Near-Term Case, MRI event durations in Future Case 1 are generally shorter, particularly during the summer





Future Case 1 Summer rMRI
- Energy Limited and Storage Resources

Resource Class	Summer MCap		Summer rMRI	
	Near-Term Base Case	Future Case 1	Near-Term Base Case	Future Case 1
Oil/Dual-Fuel (EL3)	840	840 (0)	90.9%	92.5% (+1.6%)
Energy Storage Resources (Batteries + PSH)	3,877	4,077 (+200)	55.2%	62.6% (+7.4%)
Hybrid (PV/ES + Hydro/ES)	1,053	1,053 (0)	50.8%	47.9% (-3.0%)

- Energy storage resources include both Pumped Storage Hydro and stand-alone batteries
  - Future case 1 includes an additional 200 MW of 2-hr batteries
- For energy-limited oil/dual-fuel resources and energy storage resources, rMRI values increase in Future Case 1
  - This increase is likely driven by higher behind-the-meter PV penetration in the 2035 load forecast, which shifts net peak load hours further into the evening, resulting in a more peaky load shape, and effectively shortens Type 2 MRI hours
- For hybrid resources with a majority of PV paired with energy storage, the rMRI of the PV component is expected to decline by as much as 11.7%, as explained on the later slide. Although the rMRI of the storage component increases, as noted above, the net effect is a reduction in the overall accreditation of the hybrid resource

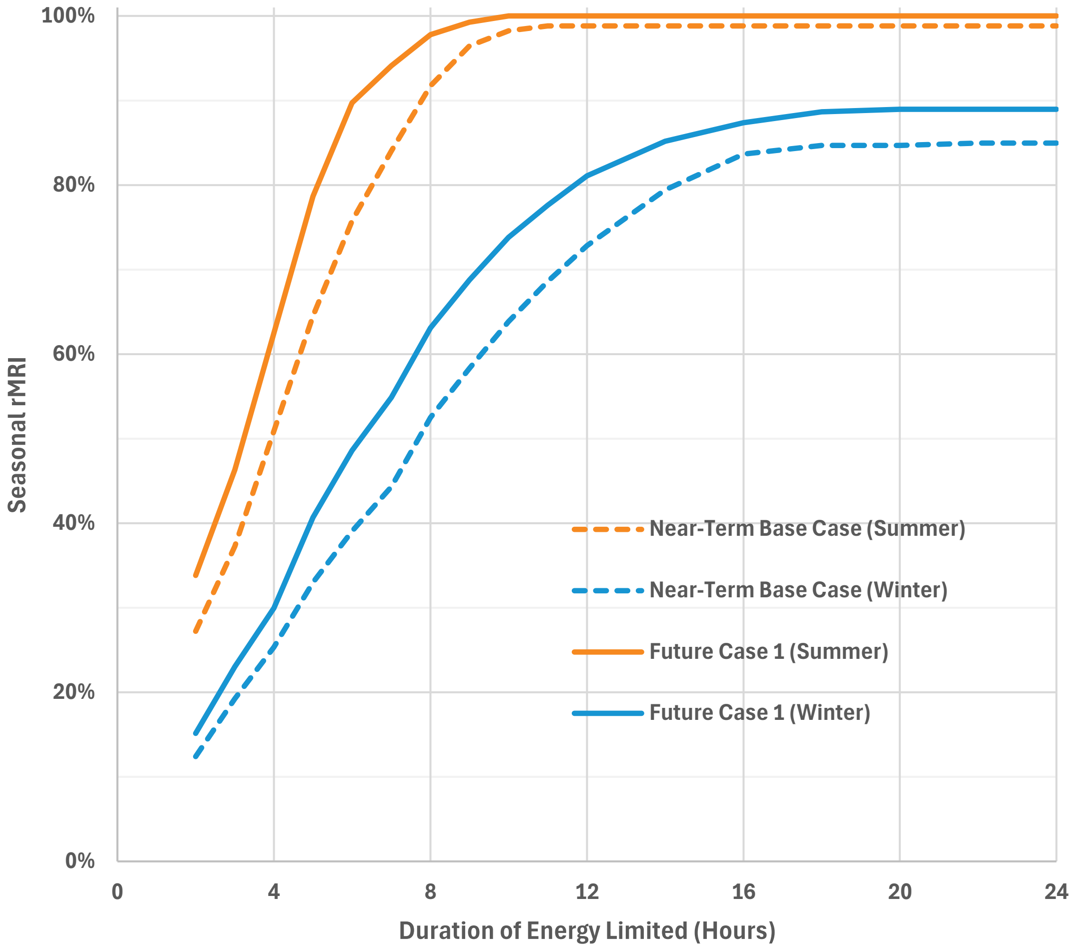
Future Case 1 Winter rMRI
- Energy Limited and Storage Resources

	Winter MCap		Winter rMRI	
Resource Class	**Near-Term Base Case**	**Future Case 1**	**Near-Term Base Case**	**Future Case 1**
Oil/Dual-Fuel (EL3)	1,019	1,019 (0)	67.2%	71.9% (+4.7%)
Energy Storage Resources (Batteries + PSH)	3,875	4,075 (+200)	20.9%	21.9% (+0.9%)
Hybrid (PV/ES + Hydro/ES)	1,048	1,048 (0)	25.2%	25.6% (+0.4%)

- For the winter, the overall MRI event durations are generally shorter in Future Case 1 than the Near-Term Base Case, resulting slight increase to the rMRI values
- While the rMRI increase for energy storage is modest on a class average level, the impact is likely larger when controlling for resource attributes because it increases even with the addition of 200 MW of two-hour batteries that tend to have lower rMRI values
- Next: Show energy limited duration curves providing more information on the accreditation values as a function of energy duration for each season, and how they compare between the Near-Term Base Case and Future Case 1

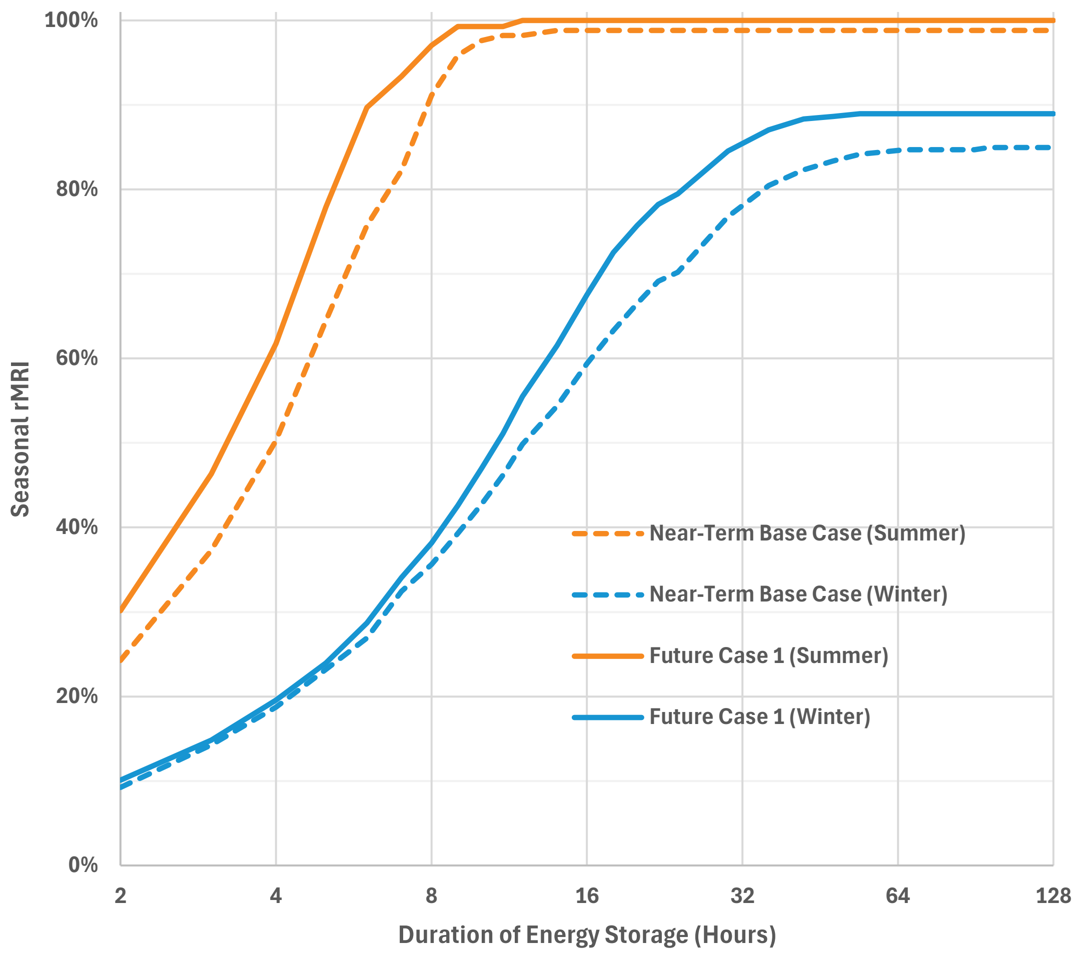
Future Case 1 Proxy Energy Limited rMRI Curve

- The rMRI values assume 0% EFORd
- In general, MRI events have shorter durations in Future Case 1, resulting in higher rMRI values for energy-limited resources



Future Case 1 Proxy Energy Storage rMRI Curve

- The rMRI values assume 0% EFORd
- Similarly, the duration of MRI events is generally shorter in Future Case 1, resulting in an increased reliability contribution for energy storage resources



Future Case 1 Summer rMRI - Profile Resources

- Future Case 1 includes 2,000 MW of new offshore wind and 200 MW of new solar additions
- The decline in wind rMRI values is driven by the increased concentration of offshore wind that has been assumed to be located near facilities in the Near-Term case, which increases the correlated impact on loss of load events
- The reduction in summer solar rMRI values is due to additional BTM PV in the 2035 load forecast, which shifts the net peak further into the evening hours when solar output further diminishes

	Summer MCap		Summer rMRI	
Resource Class	**Near-Term Base Case**	**Future Case 1**	**Near-Term Base Case**	**Future Case 1**
IPR - Wind	2,525	4,525 (+2,000)	19.9%	11.3% (-8.6%)
IPR - Solar	1,409	1,609 (+200)	24.1%	12.3% (-11.7%)
IPR - Hydro	560	560 (0)	40.7%	42.6% (+1.9%)
IPR - Others	273	273 (0)	79.8%	80.7% (+0.9%)
ADCR	794	794 (0)	22.5%	21.5% (-1.0%)
PDR	6,504	6,504 (0)	53.1%	50.9% (-2.2%)

Future Case 1 Winter rMRI - Profile Resources

- Offshore wind resources experience a similar decline in winter rMRI values, driven by increased concentration of offshore wind capacity in the proximity
- This leads to greater performance correlation - a higher likelihood of simultaneous contribution shortfalls during loss-of-load events

Resource Class	Winter MCap		Winter rMRI	
	Near-Term Base Case	Future Case 1	Near-Term Base Case	Future Case 1
IPR - Wind	2,525	4,525 (+2,000)	36.1%	28.8% (-7.3%)
IPR - Solar	1,409	1,609 (+200)	7.1%	5.8% (-1.3%)
IPR - Hydro	560	560 (0)	59.9%	62.3% (+2.4%)
IPR - Others	273	273 (0)	79.2%	79.6% (+0.4%)
ADCR	674	674 (0)	34.3%	33.1% (-1.2%)
PDR	6,186	6,186 (0)	58.7%	58.3% (-0.4%)

FUTURE CASE 2

Future Case 2: Preview of Results

- The seasonal Net ICRs are again higher to reflect forecasted increases in load
- Generally, the accreditation results are similar between Future Cases and 2
  - Energy limited and storage resources have somewhat lower rMRI values than in Future Case 1 reflecting that this case assumes incremental battery storage capability
  - Wind rMRI values decrease compared to the Near-Term Base Case and Future Case 1 due to the assumption of incremental wind capacity, where this increases the likelihood that reliability events occur when wind resources are performing comparatively poorly

Future Case 2 Net ICR

- This table summarizes system capacity and load, net ICR expressed in both MCap and MRIC terms, and key reliability metrics for Future Case 2, along with a comparison to Future Case 1
- With an additional 2,700 MW of renewable resources (in MCap), the average MW performs worse when compared to perfect capacity, thereby requiring a higher NICR in MCap terms

	Summer		Winter	
	Future Case 1	Future Case 2	Future Case 1	Future Case 2
Seasonal MCap (MW)	39,470	42,170 (+2,700)	40,067	42,767 (+2,700)
50/50 Net Peak (MW)	27,331	27,331 (0)	25,908	25,908 (0)
ALCC in %	7.8%	10.8% (+3.0%)	4.1%	7.0% (+2.9%)
Net ICR in MCap (MW)	36,625	38,052 (+1,427)	38,493	39,970 (+1,477)
LOLE (days/season)	0.05	0.05 (0)	0.05	0.05 (+0.00)
LOLH (hours/season)	0.16	0.17 (+0.01)	0.29	0.31 (+0.02)
EUE (MWh/season)	135	154 (+18)	530	607 (+77)
System MRIC (MW)	27,874	28,394 (+520)	27,273	27,726 (+453)
Net ICR in MRIC (MW)	25,864	25,621 (-244)	26,202	25,913 (-289)
System rMRI	70.6%	67.3% (-3.3%)	68.1%	64.8% (-3.2%)

Future Case 2 Summer rMRI for Thermal Modeled Resources

- The rMRI values of these resources under the Future Case 2 are very similar to the Future Case 1 values
  - MCap and EFORd values are the same for these two cases

Resource Class	Summer MCap		Summer rMRI	
	Future Case 1	Future Case 2	Future Case 1	Future Case 2
Gas-only	8,006	8,006 (0)	92.4%	92.4% (0%)
Oil/Dual-Fuel (Thermal)	10,516	10,516 (0)	83.4%	83.7% (+0.2%)
Daily/Weekly Hydro	1,067	1,067 (0)	95.4%	95.0% (-0.4%)
Other Thermal (including Nuclear)	3,947	3,947 (0)	88.0%	88.4% (+0.4%)
Imports	2,205	2,205 (0)	92.4%	92.1% (-0.3%)

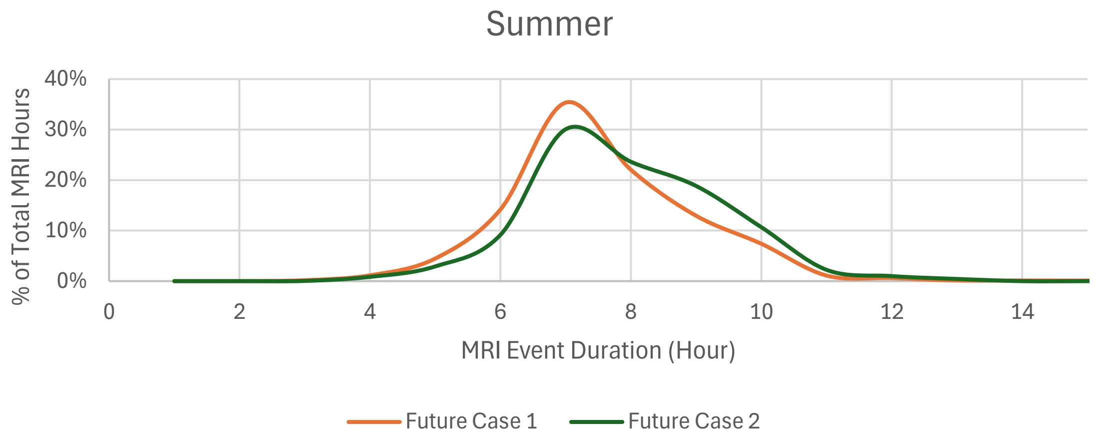
Future Case 2 Winter rMRI for Thermal Modeled Resources

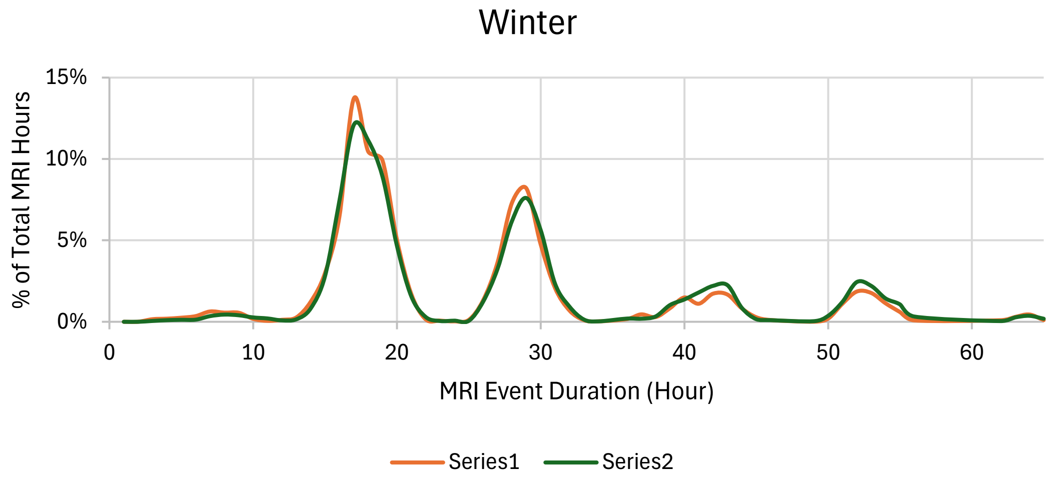
- The reliability values of these thermal resources are also similar between these two future cases during winter

Resource Class	Winter MCap		Winter rMRI	
	Future Case 1	Future Case 2	Future Case 1	Future Case 2
Gas-only	8,637	8,637 (0)	92.4%	92.4% (0%)
Oil/Dual-Fuel (Thermal)	11,287	11,287 (0)	83.1%	83.2% (+0.1%)
Daily/Weekly Hydro	1,060	1,060 (0)	96.4%	96.1% (-0.3%)
Other Thermal (including Nuclear)	3,968	3,968 (0)	91.5%	91.9% (+0.4%)
Imports	1,331	1,331 (0)	89.2%	89.2% (0%)

MRI Event Duration Distribution Comparison

- The durations of MRI events in Future Case 2 are slightly longer than Future Case 1, by about 0.5 hour in summer and 1 hour in winter on a weighted average basis





Future Case 2 Summer rMRI
- Energy Limited and Storage Resources

Resource Class	Summer MCap		Summer rMRI	
	Future Case 1	Future Case 2	Future Case 1	Future Case 2
Oil/Dual-Fuel (EL3)	840	840 (0)	92.5%	91.3% (-1.2%)
Energy Storage Resources (Batteries + PSH)	4,077	4,777 (+700)	62.6%	60.7% (-1.9%)
Hybrid (PV/ES + Hydro/ES)	1,053	1,053 (0)	47.9%	46.9% (-1.0%)

- MRI event durations are slightly longer in Future Case 2 due to the addition of renewable resources and batteries, resulting in a slight decrease in rMRI values for energy-limited and storage resources as compared to Future Case 1
  - The rMRI values for these energy limited and storage resources remain higher than under the Near-Term Base Case, though the Hybrid rMRI decreases

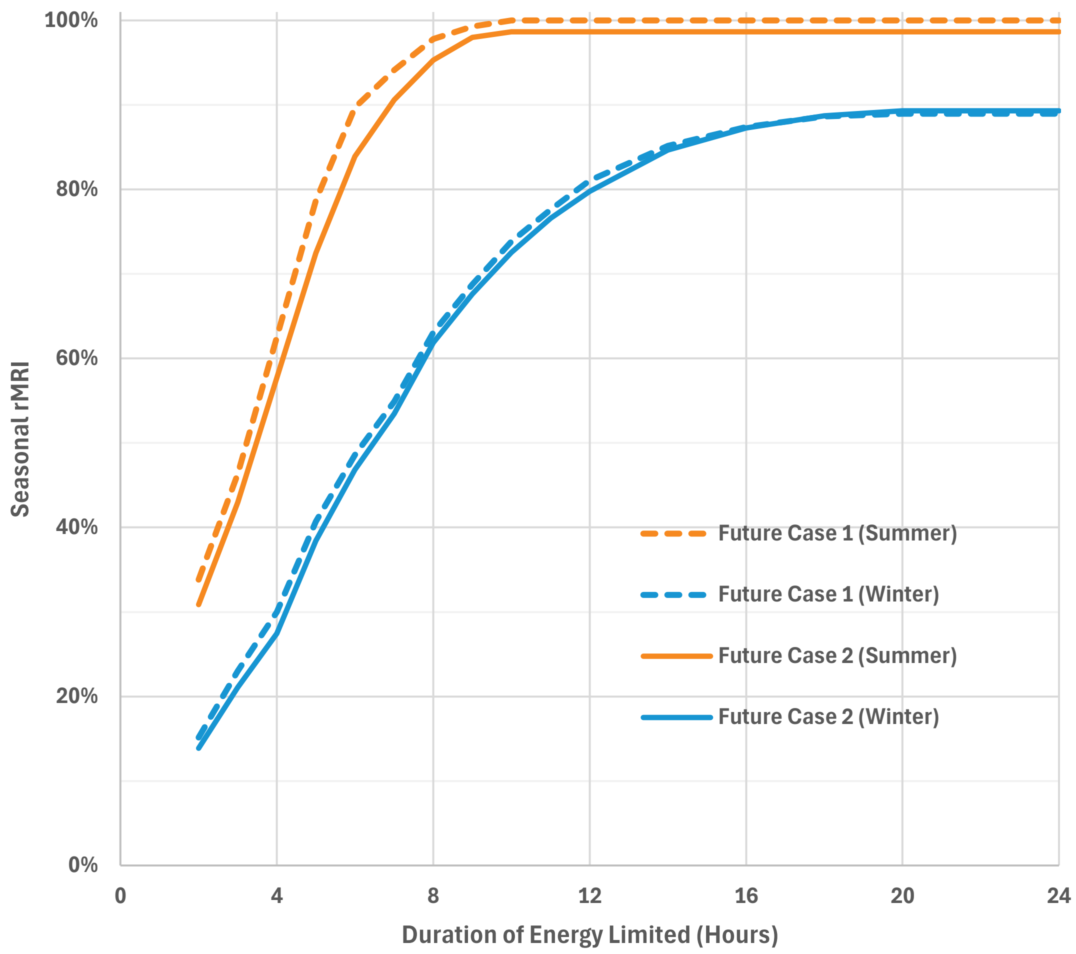
Future Case 2 Winter rMRI
- Energy Limited and Storage Resources

	Winter MCap		Winter rMRI	
Resource Class	**Future Case 1**	**Future Case 2**	**Future Case 1**	**Future Case 2**
Oil/Dual-Fuel (EL3)	1,019	1,019 (0)	71.9%	71.9% (0%)
Energy Storage Resources (Batteries + PSH)	4,075	4,775 (+700)	21.9%	21.5% (-0.4%)
Hybrid (PV/ES + Hydro/ES)	1,048	1,048 (0)	25.6%	25.4% (-0.2%)

- During the winter, the output from additional 1,500 MW wind added in Future Case 2 is generally higher than in the summer, which helps offset the aggregate impacts on energy-limited and storage resources observed during summer conditions
  - rMRI values are higher than in the Near-Term Base Case

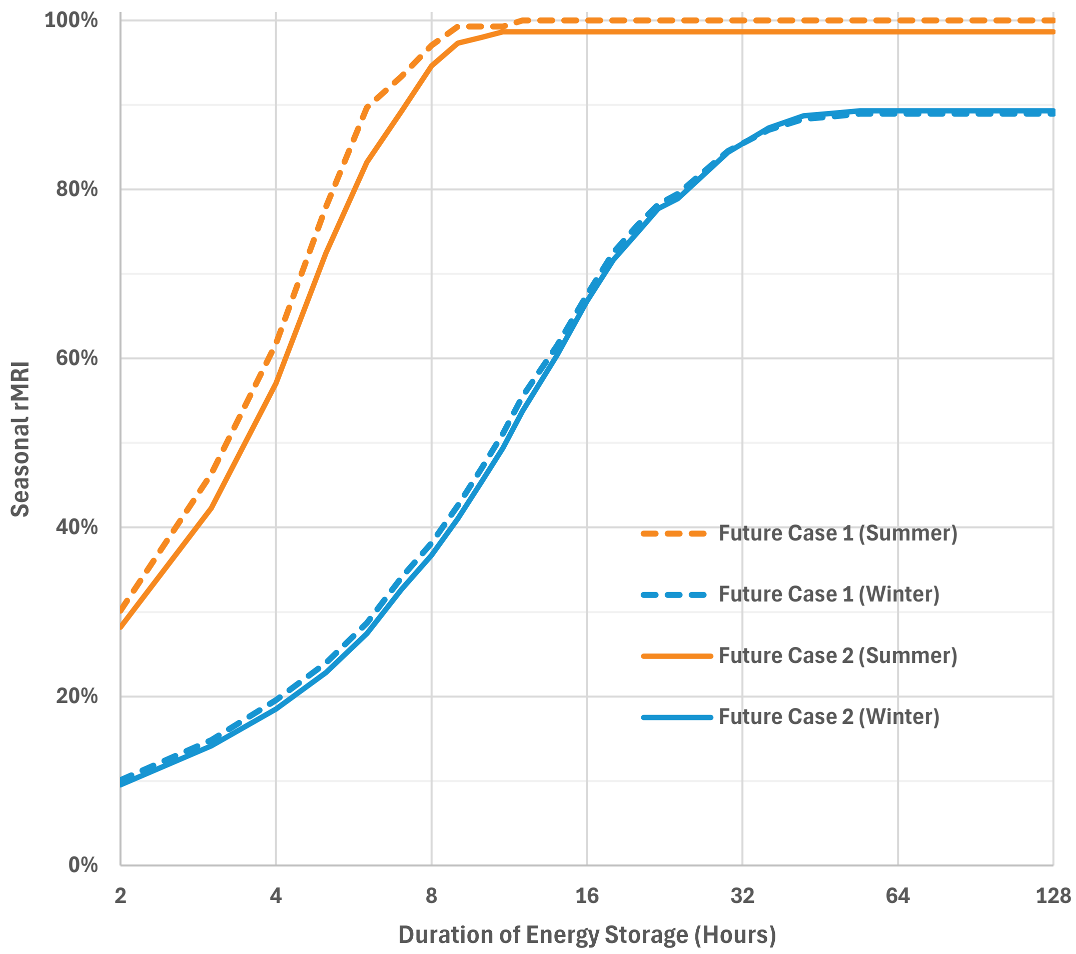
Future Case 2 Proxy Energy Limited Resource rMRI Curve

- The rMRI values assume 0% EFORd
- In general, MRI events have slightly longer durations in Future Case 2, resulting in slightly lower rMRI values for energy-limited resources



Future Case 2 Proxy Energy Storage rMRI Curve

- The rMRI values assume 0% EFORd
- Similarly, MRI events have slightly longer durations in Future Case 2, resulting in slightly lower rMRI values for energy-limited resources during winter



Future Case 2 Summer rMRI - Profile Resources

- Unlike the larger impact on wind rMRI in Future Case 1 resulting from additional wind resources relative to the Near-Term Base Case, the incremental impact of added wind in Future Case 2 relative to Future Case 1 is small
- This is because the additional wind resources in Future Case 2 are assumed to be located farther from existing wind sites

Resource Class	Summer MCap		Summer rMRI	
	Future Case 1	Future Case 2	Future Case 1	Future Case 2
IPR - Wind	4,525	6,025 (+1,500)	11.3%	10.0% (-1.3%)
IPR - Solar	1,609	2,109 (+500)	12.4%	12.8% (+0.4%)
IPR - Hydro	560	560 (0)	42.6%	42.6% (0%)
IPR - Others	273	273 (0)	80.7%	80.5% (-0.2%)
ADCR	794	794 (0)	21.5%	21.6% (+0.1%)
PDR	6,504	6,504 (0)	50.9%	50.6% (-0.3%)

Future Case 2 Winter rMRI - Profile Resources

- Similar to summer, the incremental impacts of additional wind resources are smaller in winter, reflecting weaker correlation with existing wind resources

Resource Class	Winter MCap		Winter rMRI	
	Future Case 1	Future Case 2	Future Case 1	Future Case 2
IPR - Wind	4,525	6,025 (+1,500)	28.8%	26.0% (-2.8%)
IPR - Solar	1,609	2,109 (+500)	5.8%	5.9% (+0.1%)
IPR - Hydro	560	560 (0)	62.3%	62.2% (-0.1%)
IPR - Others	273	273 (0)	79.6%	79.3% (-0.3%)
ADCR	674	674 (0)	33.1%	33.0% (-0.1%)
PDR	6,186	6,186 (0)	58.3%	58.0% (-0.3%)

FUTURE CASE 3

Future Case 3: Preview of Results

- Net ICR values increase significantly relative to the Near-Term Base Case, particularly in winter, driven by projected load growth and the substantial addition of wind, solar, and battery resources assumed to meet future capacity and energy needs
- Load characteristics associated with high electrification and the assumed resource mix result in shorter reliability events, but also lead to higher unserved energy during winter conditions
  - As a result, energy-limited and energy storage resources experience larger increases in accreditation values, with the increase for the energy storage class also attributed to the addition of longer-duration batteries
- Wind and solar resources exhibit declines in average seasonal rMRI values relative to the Near-Term Base Case, which are driven by:
  - Very significant increase in the assumed quantities of these resource types, meaning reliability events are more likely to occur during periods with limited wind and solar power generation
  - The assumed geographic proximity of wind resources for this case, which may lead to stronger correlations in than would be expected in practice
- Accreditation values for other resource classes remain broadly consistent with Near-Term Base Case levels across both seasons

Future Case 3 Net ICR

- This table summarizes system capacity and load, Net ICR expressed in both MCap and MRIC terms, and key reliability metrics for the near-term base case and Future Case 3
- When compared to the Near-Term Base Case, the increase in demand is significant, especially in the winter, reflecting the higher 2040 load forecast
- The incremental capacity tends to have lower rMRI values, on average, leading to larger increases in MCap to meet these higher load levels

	Summer		Winter	
	Near-Term Base Case	Future Case 3	Near-Term Base Case	Future Case 3
Seasonal MCap (MW)	37,070	64,470 (+27,400)	37,667	65,067 (+27,400)
50/50 Net Peak (MW)	25,124	29,770 (+4,646)	21,101	30,682 (+9,581)
ALCC in %	15.8%	13.3% (-2.5%)	31.6%	0.5% (-31.1%)
Net ICR in MCap (MW)	32,016	56,922 (+24,906)	28,620	64,760 (+36,140)
LOLE (days/season)	0.05	0.05 (+0.00)	0.05	0.05 (+0.00)
LOLH (hours/season)	0.16	0.15 (-0.01)	0.28	0.26 (-0.02)
EUE (MWh/season)	147	124 (-23)	325	678 (+353)
System MRIC (MW)	27,362	32,346 (+4984)	26,083	31,601 (+5,518)
Net ICR in MRIC (MW)	23,631	28,559 (+4,927)	19,819	31,452 (+11,633)
System rMRI	73.8%	50.2% (-23.6%)	69.2%	48.6% (-20.7%)

Future Case 3 Summer rMRI for Thermal Modeled Resources

- This table compares summer rMRI values for thermal modeled resources between the Near-Term Base Case and Future Case 3
- In general, because these resources are not energy-constrained, the addition of more IPRs, energy-limited and energy storage resources to the system increases their relative reliability value, resulting in a slight increase in their rMRI values

Resource Class	Summer MCap		Summer rMRI	
	Near-Term Base Case	Future Case 3	Near-Term Base Case	Future Case 3
Gas-only	8,006	8,006 (0)	91.9%	93.1% (+1.1%)
Oil/Dual-Fuel (Thermal)	10,516	10,516 (0)	82.1%	84.3% (+2.2%)
Daily/Weekly Hydro	1,067	1,067 (0)	95.0%	95.1% (+0.1%)
Other Thermal (including Nuclear)	3,947	3,947 (0)	86.9%	90.1% (+3.2%)
Imports	2,205	2,205 (0)	91.5%	92.1% (+0.6%)

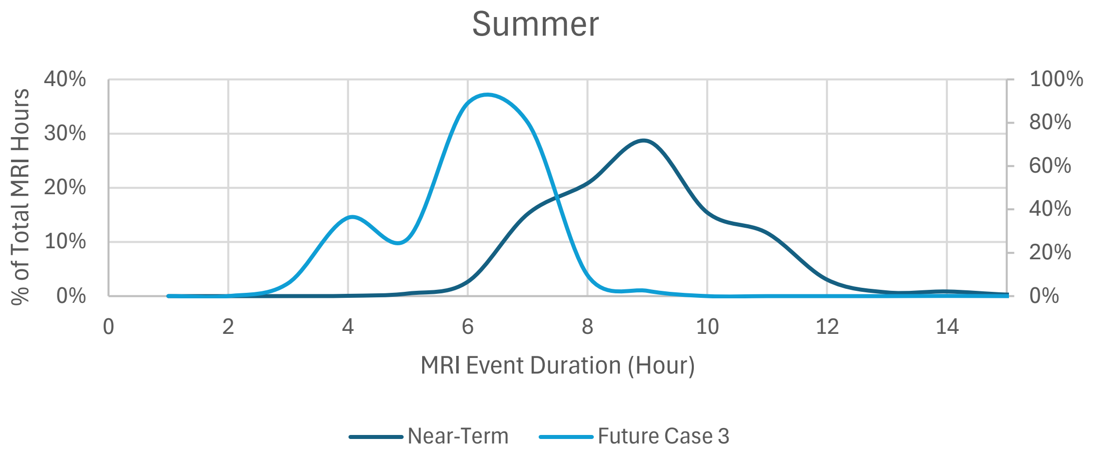
Future Case 3 Winter rMRI for Thermal Modeled Resources

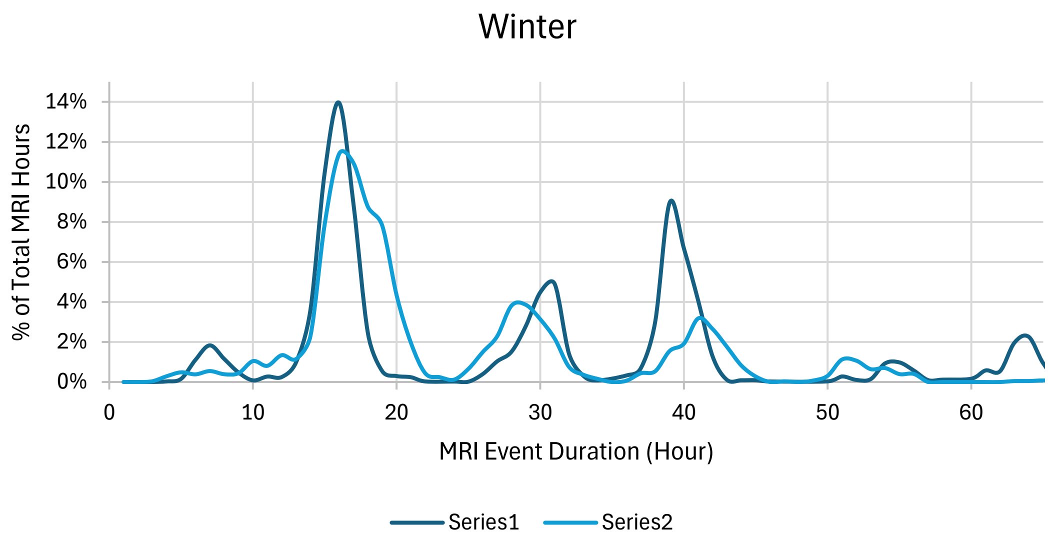
- Similarly, the reliability values of these energy-rich resources increase even further in winter as additional IPRs, energy-limited, and energy storage resources are added, reflecting the more energy-intensive nature of winter conditions relative to summer

Resource Class	Winter MCap		Winter rMRI	
	Near-Term Base Case	Future Case 3	Near-Term Base Case	Future Case 3
Gas-only	8,637	8,637 (0)	91.0%	93.4% (+2.4%)
Oil/Dual-Fuel (Thermal)	11,287	11,287 (0)	79.3%	84.6% (+5.3%)
Daily/Weekly Hydro	1,060	1,060 (0)	96.2%	96.3% (+0.1%)
Other Thermal (including Nuclear)	3,968	3,968 (0)	88.7%	93.9% (+5.2%)
Imports	1,331	1,331 (0)	88.4%	89.7% (+1.3%)

MRI Event Duration Distribution Comparison

- During summer, MRI event durations in Future Case 3 are generally shorter (about 3 hours on weighted average)
- During winter, the major MRI event durations are broadly aligned across cases, with some variation in frequency; however, on a weighted-average basis, MRI event durations in Future Case 3 are approximately 5 hours shorter





Future Case 3 Summer rMRI
- Energy Limited and Storage Resources

Resource Class	Summer MCap		Summer rMRI	
	Near-Term Base Case	Future Case 3	Near-Term Base Case	Future Case 3
Oil/Dual-Fuel (EL3)	840	840 (0)	90.9%	92.5% (+1.6%)
Energy Storage Resources (Batteries + PSH)	3,877	6,877 (+3000)	55.2%	80.0% (+24.8%)
Hybrid (PV/ES + Hydro/ES)	1,053	1,053 (0)	50.8%	48.2% (-2.6%)

- For energy-limited oil/dual-fuel resources and energy storage resources, rMRI values increase in Future Case 3. This increase is driven primarily by shorter-duration MRI events resulting from higher behind-the-meter PV penetration in the 2040 load forecast, which shifts net peak load hours further into the evening, creates a more peaky net load shape, and effectively shortens Type 2 MRI hours. The increase in rMRI for the ES resource class is also supported by the addition of longer-duration batteries in Future Case 3
- For hybrid resources dominated by PV paired with energy storage, the rMRI of the PV component is expected to decline, as discussed on a later slide. While the rMRI of the storage component (typically 2-hour batteries) would increase, as noted above, the combined effect is a reduction in the overall accreditation of the hybrid resource

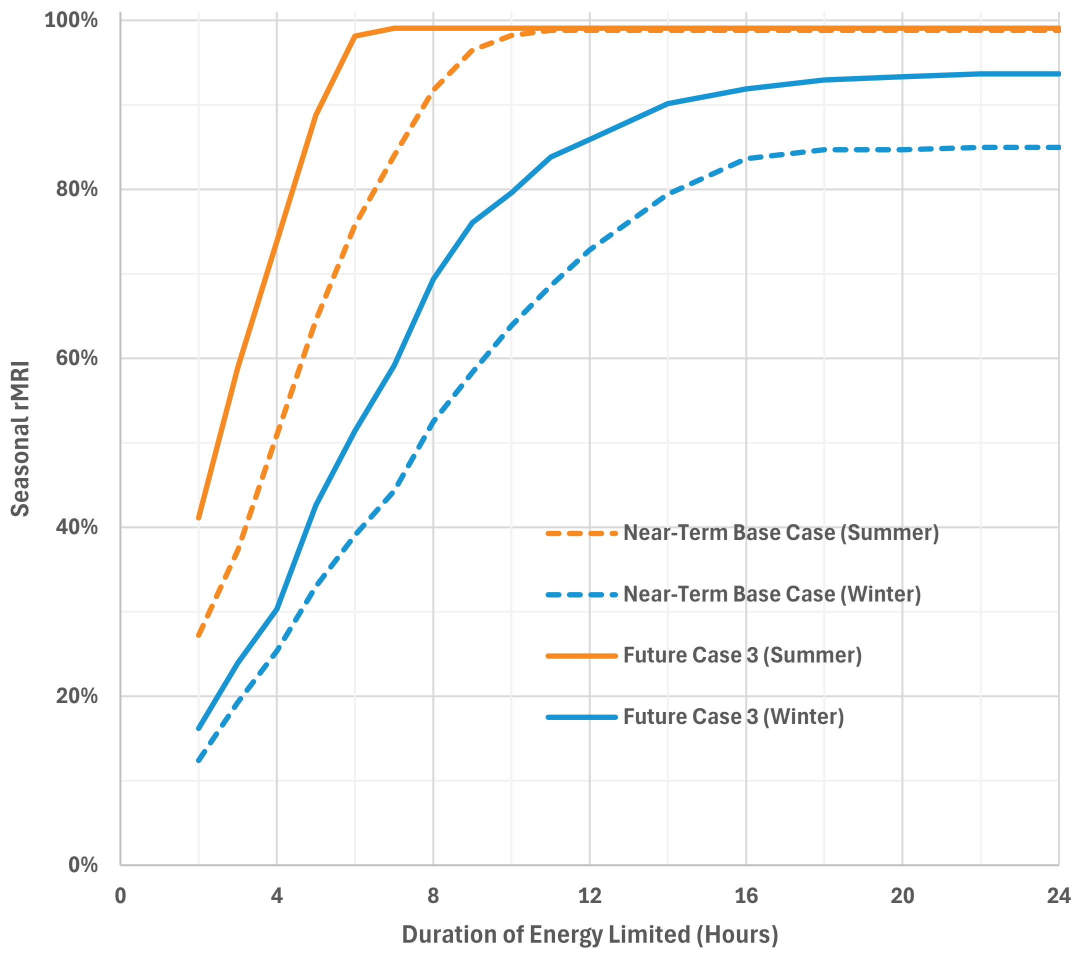
Future Case 3 Winter rMRI
- Energy Limited and Storage Resources

	Winter MCap		Winter rMRI	
Resource Class	Near-Term Base Case	Future Case 3	Near-Term Base Case	Future Case 3
Oil/Dual-Fuel (EL3)	1019	1,019 (0)	67.2%	76.3% (+9.0%)
Energy Storage Resources (Batteries + PSH)	3,875	6,875 (+3000)	20.9%	39.3% (+18.3%)
Hybrid (PV/ES + Hydro/ES)	1,048	1,048 (0)	25.2%	25.7% (+0.5%)

- For the winter, the overall MRI event durations are shorter, resulting in an increase to the rMRI values
- The increase for the ES resource class is also attributed to the addition of longer-duration batteries in Future Case 3

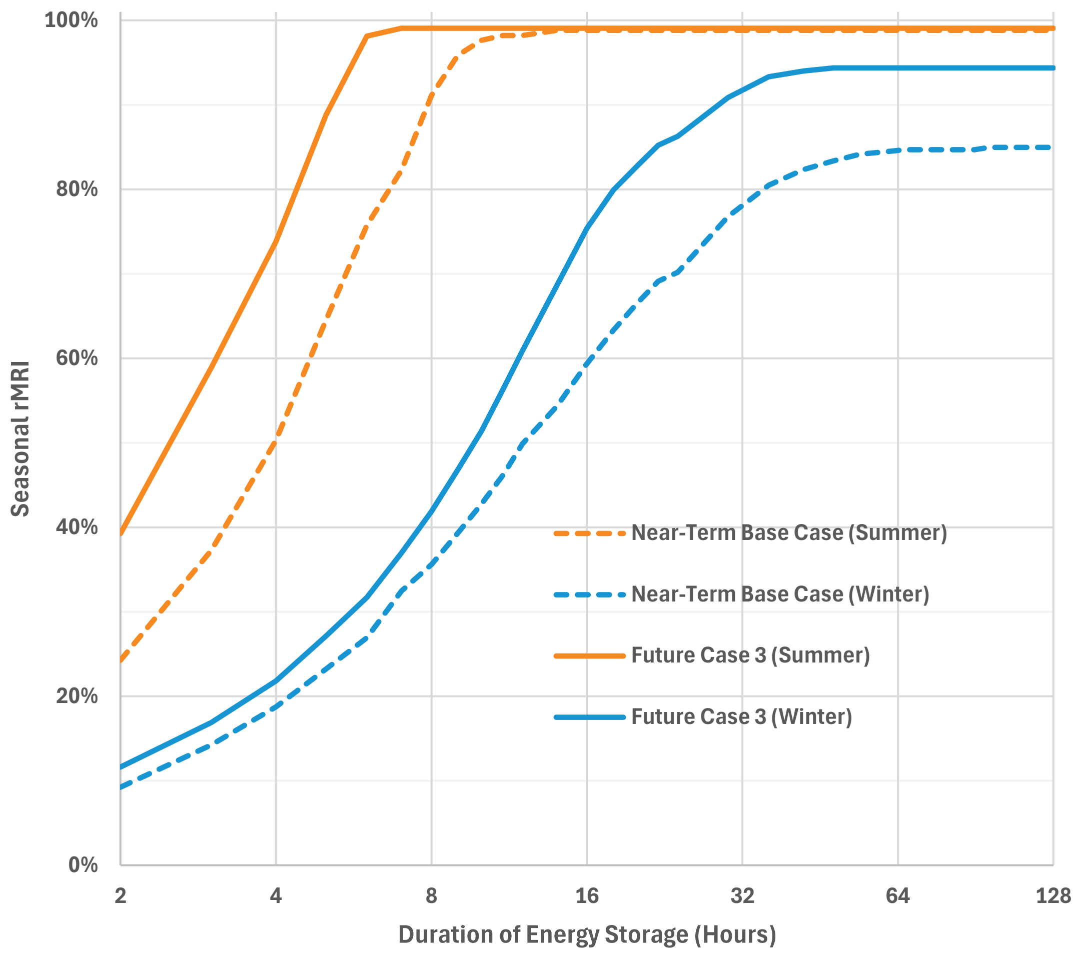
Future Case 3 Proxy Energy Limited Resource rMRI Curve

- The rMRI values assume 0% EFORd
- Shorter MRI events in Future Case 3 result in higher rMRI values for energy-limited resources. During the summer, a 6-hour duration is able to achieve nearly 100% accreditation under this resource mix assumption



Future Case 3 Proxy Energy Storage rMRI Curve

- The rMRI values assume 0% EFORd
- Similarly, shorter MRI events in Future Case 3 also result in higher rMRI values for energy storage resources



Future Case 3 Summer rMRI - Profile Resources

- The resources most affected in Future Case 3 are wind and solar resources, which exhibit lower rMRI values
- This reduction in rMRI is driven by the substantial assumed additions of wind and solar capacity relative to the Near-Term Base Case
  - Wind MCap increases by more than 550% relative to the Near-Term Base Case
  - Solar MCap increases by more than 700% relative to the Near-Term Base Case
- Future Case 3 also assumes that much of the wind capacity is located in close proximity; if the wind resources were to exhibit more geographic diversity, the rMRI values for this class would be expected to increase
- The reduction in summer solar rMRI values is primarily attributable to increased behind-the-meter PV in the 2040 load forecast and the additional utility solar assumed, which shifts net peak load further into the evening hours when solar output is more limited

	Summer MCap		Summer rMRI	
Resource Class	**Near-Term Base Case**	**Future Case 3**	**Near-Term Base Case**	**Future Case 3**
IPR - Wind	2,525	16,525 (+14,000)	19.9%	6.4% (-13.5%)
IPR - Solar	1,409	11,809 (+10,400)	24.1%	8.0% (-16.1%)
IPR - Hydro	560	560 (0)	40.7%	43.8% (+3.1%)
IPR - Others	273	273 (0)	79.8%	81.1% (+1.2%)
ADCR	794	794 (0)	22.5%	21.4% (-1.1%)
PDR	6,504	6,504 (0)	53.1%	49.6% (-3.5%)

Future Case 3 Winter rMRI - Profile Resources

- As with the summer results, wind and solar resources see a decline in the rMRI values
- The wind rMRI decrease is largely driven by the more than 550% increase in its MCap relative to the Near-Term Base Case
- Future Case 3 also assumes that much of the wind capacity is located in close proximity; if the wind resources were to exhibit more geographic diversity, the rMRI values for this class would be expected to increase

Resource Class	Winter MCap		Winter rMRI	
	Near-Term Base Case	Future Case 3	Near-Term Base Case	Future Case 3
IPR - Wind	2,525	16,525 (+14,000)	36.1%	17.8% (-18.3%)
IPR - Solar	1,409	11,809 (+10,400)	7.1%	4.9% (-2.2%)
IPR - Hydro	560	560 (0)	59.9%	61.5% (+1.6%)
IPR - Others	273	273 (0)	79.2%	79.6% (+0.5%)
ADCR	674	674 (0)	34.3%	32.0% (-2.3%)
PDR	6,186	6,186 (0)	58.7%	56.8% (-1.9%)

CONTINUED DESIGN CONSIDERATIONS

Background: ISO Seeks to Bring Design Elements and Share IA Results in a Timely Manner

- Throughout CAR, the ISO has sought to keep stakeholders appraised of its thinking regarding design elements
- In practice, this means providing information and outlining approaches in cases where the assessment is ongoing
  - For example, the GE MARS technical sessions
- Provides a degree of insight to the process, and allows the ISO to hear and consider stakeholder questions and feedback early on
- The ISO made a number of changes to the CAR-PD proposal to reflect stakeholder feedback, and we expect that there will be additional updates to the CAR-SA design as well
- Today, we discuss the continued evaluation of the energy limited and storage resources with the understanding that it is of considerable interest to some stakeholders
  - ISO continues to evaluate other elements of the proposed design as well, and appreciates continued stakeholder feedback

Background: Accreditation of Energy Limited and Storage Resources

- Began discussing the methodology to accredit energy limited and storage resources in November 2025
  - Energy limited presentation and memo
  - Storage presentation and memo
- Shared preliminary accreditation values for the Near-Term Base Case and Future Case 1 in the RAM IA results presented at the March 2026 MC
- The values presented showed that these resource types generally see:
  - Lower rMRI values than some other resource types, especially in winter
  - Increasing rMRI values with increased energy storage duration (all else equal)
- The March materials walked through the model outputs that informed these results, including that many reliability events (especially in the winter) are driven by energy limitations that manifest over extended periods

Accreditation of Energy Limited and Storage Resources

- Some stakeholders raised concerns about the accreditation values associated with energy limited and storage resources and questioned whether these values appropriately reflect the reliability contributions of these resources
- Next: Discuss the factors that shape these values further, and provide an update on the ISO's current thinking regarding the modeling of these resources

RAM IA Cases Assumes Significant Storage Capability

- Before diving further into the modeling assumptions and mechanics, some context on the resource mix assumptions that inform the results
- Recall: A key feature of the proposed accreditation design is that the rMRI values are derived as a function of the observed resource mix
  - Observed this in how the rMRI results for resource classes varied between the cases run, where when significant quantities of a class were added, the average rMRI of this class tended to decrease
- The Near-Term Base Case assumes a resource mix that includes all of the existing commercial energy storage resources (~1,900 MW) plus ~2,000 MW that are not yet commercial but had qualified in ARA1 for CCP 18 and 2025 Interim Qualification
  - This yields a total of ~3,900 MW of standalone energy storage in the model, as measured in MCap
  - There is additional energy storage modeled as hybrid as well as energy limited resources
- These penetration levels are considerably higher than what is present today, what was assumed in the RCA IA, or what has been observed in other regions with capacity accreditation rules (as a percent of total capacity)

RAM IA Cases Assumes Significant Storage Capability

- Assuming lower levels of energy storage would tend to increase the rMRI values associated with this resource class
- This impact is more acute in the winter as the flatter load shape means reliability events are more likely to be driven by limited energy over sustained high-load periods
- Intuition: When there are comparatively fewer energy limited and storage resources (and comparatively more thermal and intermittent resources), reliability events are less likely to be driven by system energy limitations

Accounting for Energy Limitations in the RAA Model

- Under current rules, the ISO does not consider energy limitations in the RAA modeling process or in the determination of QC values for energy limited or energy storage resources
- It is not surprising that once we account for these limitations, these resources will see a decrease in their accreditation values
- However, in practice, the modeling of energy limited and storage resources is challenging and requires the development of assumptions governing how these resources operate during reliability events and when there is surplus available energy from non-energy limited resources
  - See, for example, the earlier discussion of the charging and discharging order logic
- This is particularly important for these resources because the assumption regarding their operation in hour *t* will affect their ability to operate in hour *t+1* (and beyond)
- Next: Walk through some of these model assumptions

Key Model Assumptions: Operation of Energy Limited and Storage Resources

- While we focus on reliability events where system conditions are very tight, the large majority of modeled hours have more than enough generation to meet load and system reliability
- During these 'normal' hours, the model assumes that:
  - Energy limited and storage resources do not discharge any of their energy
  - Any energy storage resource that is not already fully charged will consume any surplus energy that is available from thermal and IPR resources until it is fully charged
- The model therefore assumes that we first use all available generation from thermal and IPR resources, and only deploy energy limited and storage resources to avoid or reduce EUE MWh
- Observation: This narrow deployment of energy limited and storage resources will tend to result in higher rMRI values for energy limited and storage resources than other approaches because by saving their limited energy for MRI hours, it maximizes their contributions to reducing EUE MWh during such events
  - If we instead assumed such resources discharged in a broader set of conditions, this could lead to cases where at the beginning of a reliability event, they are not fully charged and therefore contribute less to reducing EUE

Key Model Assumption: Energy Limited and Storage Dispatch Order

- There can be cases where a portion of the capability from energy limited and storage resources is needed to avoid EUE, but not the entire capacity
- As discussed earlier in the presentation, during such cases the ISO's proposal would dispatch resources from longest-to-shortest, as this more efficiently utilizes the region's total limited energy than the other configurations considered
- Observation: It is not feasible in the scope of CAR to develop a novel methodology to modify the dispatch order logic to fully maximize the contributions of energy limited and storage resources, as such a methodology would depend on, among other things:
  - Events in the future, including the duration/characteristics of any current/future reliability events
  - The characteristics of the energy limited and storage resources, including their current state of charge, maximum storage capability, timing of next replenishment (if energy limited), round-trip efficiency, etc.
  - Further assessment could be considered after CAR

Key Model Assumption: Energy Limited and Storage Resource Performance During MRI Charging Hours

- As previously discussed the model also assumes that energy limited and storage resources are never discharged to charge other energy storage resources
- This assumption will generally reduce rMRI values, especially for longer duration energy storage resources that could have charged other energy storage resources in those hours
- It also means that the accreditation of such resources depends on the frequency of charging MRI hours

Stakeholders Have Noted This Model Assumption May Underestimate the Reliability Contributions of Energy Limited and Storage Resources

- For example, this assumption means that energy limited and storage resources provide no reliability value during MRI charging hours because they are not able to charge other energy storage resources
- In the Near-Term Base Case, this assumption would limit the rMRI value of an energy limited or storage resource with an incredibly large storage capability and otherwise perfect performance to:
  - 0.99 in the summer
  - 0.85 in the winter
- Generally, we would expect a resource with very large storage capability and perfect performance to have an rMRI equal to 1.0 in both seasons to reflect that it provides comparable reliability value to perfect capacity

The ISO is Currently Assessing Potential Remedies to Account for this Model Assumption

- The ISO recognizes that the model's assumption that energy limited and storage resources cannot charge other storage resources may, under some conditions, undercount the reliability contributions of such resources
- The ISO is evaluating whether it is possible to make adjustments to the proposal that account for this limitation, and its potential impact on energy limited and storage accreditation values
  - Still evaluating feasibility of any such adjustment
- This limitation appears to have a larger impact in the winter than summer, and if an adjustment is proposed, we expect it would have a more material impact on energy limited and storage accreditation values in the winter

The ISO Continues to Assess CAR Design Elements and Welcomes Stakeholder Feedback

- The ISO continues to assess elements of the CAR design and seeks stakeholder input on the proposal
- Our aim in the coming months is to continue to provide information about the proposal in a prompt manner, and to consider areas where refinements or enhancements may be possible
- In cases where such modifications are not possible as part of CAR (due to time/resource/scope challenges), the ISO may consider whether they could be pursued after the core design is completed

Next Steps

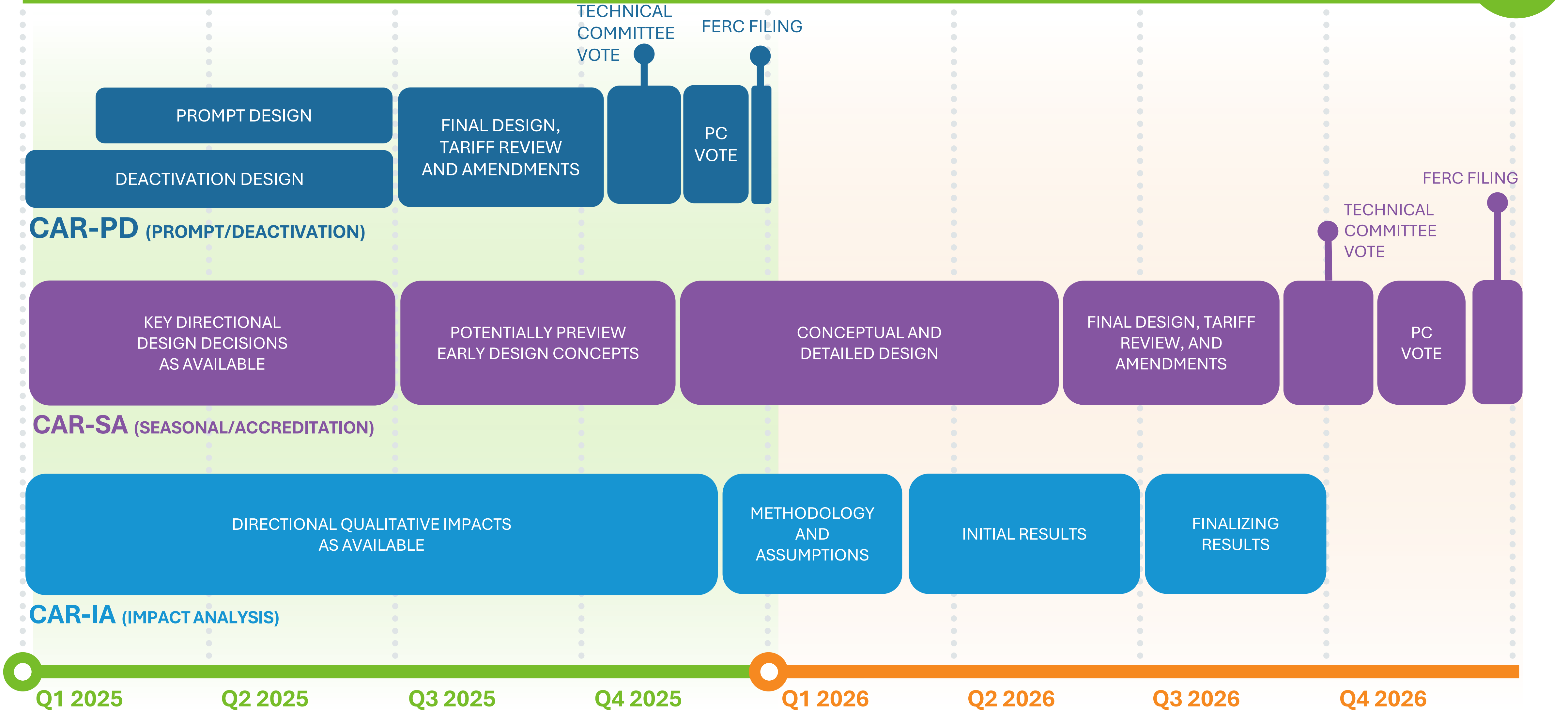
The ISO plans to continue discussing the Impact Analysis in the coming months, with the following targets for when materials will be presented:

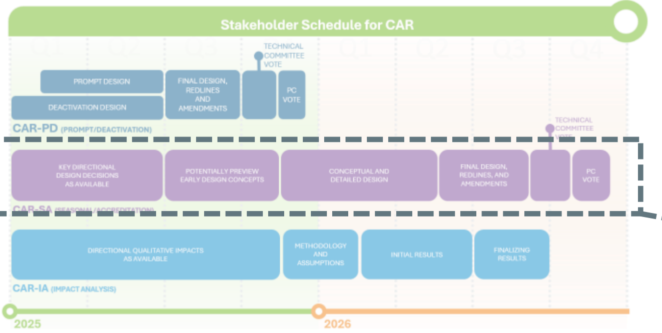
- May – Any additional Resource Accreditation Modeling IA results
- May – June: Share Market Clearing IA results
- Q3: Present final IA results reflecting any updates to the proposal informed by ISO analysis and/or stakeholder discussion

Questions

STAKEHOLDER SCHEDULE

Stakeholder Schedule for CAR





CAR-SA

Stakeholder Schedule for CAR-SA

CAR-SA (SEASONAL/ACCREDITATION)

- CORE MODELING AND ACCREDITATION CONCEPTS
- SEASONAL/ACCREDITATION MODELING AND MARKET DESIGN
- CONFORMING DESIGN DETAILS
- FINAL DESIGN, TARIFF REVIEW AND AMENDMENTS
- TECHNICAL COMMITTEE VOTE
- PC VOTE
- FERC FILING

Stakeholder Activity

- PROVIDE QUESTIONS AND FEEDBACK ON DESIGN
- CONCEPTUAL AMENDMENTS
- PRESENT AMENDMENTS

ISO Activity

- PRESENT DESIGN & RESPOND TO FEEDBACK
- PROVIDE QUESTIONS AND FEEDBACK ON AMENDMENTS

Q4 2025 | Q1 2026 | Q2 2026 | Q3 2026 | Q4 2026

CAR-SA Schedule Projection (Continued)

- **April**
  - Resource Accreditation Modeling: Impact Analysis, Continued Discussion (MC timeframe)
  - Market Clearing Impact Analysis, Continued Discussion on Assumptions and Methodology (MC timeframe)
  - Gas-Only Resource Contract Requirements (MC timeframe)
  - Gas Demand Curve, follow-ups and continued detailed design discussion (MC timeframe)
  - Import Resource Modeling and Accreditation, continued discussion (MC timeframe)
  - Capacity Market Cost Allocation, Continued Discussion (MC timeframe)
  - Competitive Offer Construction and Mitigation (MC timeframe)
  - Qualification Process (MC timeframe)
  - Installed Capacity Requirement and Zonal Demand Curves (RC timeframe)
  - MCap and DCap Summary (RC timeframe)
  - Deactivation under CAR-SA (TC timeframe)
  - Quarterly Follow-up Medley (MC timeframe)

CAR-SA Schedule Projection (Continued)

- **May**
  - Resource Accreditation Modeling: Impact Analysis, Continued Discussion (MC timeframe)
  - Market Clearing Impact Analysis, Initial Results Presentation (MC timeframe)
  - Gas-Only Resource Contract Requirements, Continued Discussion(MC timeframe)
  - Gas Demand Curve, follow-ups and continued detailed design discussion, if needed (MC timeframe)
  - Import Resource Modeling and Accreditation, continued discussion (MC timeframe)
  - Competitive Offer Construction and Mitigation, continued discussion (MC timeframe)
  - Qualification Process, continued discussion (MC timeframe)
  - Bilaterals (MC timeframe)
  - Preliminary Activity Schedule (MC timeframe)
  - DECR Accreditation and Modeling (RC timeframe)
  - Installed Capacity Requirement and Tie Benefits Follow Ups (RC timeframe)
  - Capacity Zone Formation (RC timeframe)

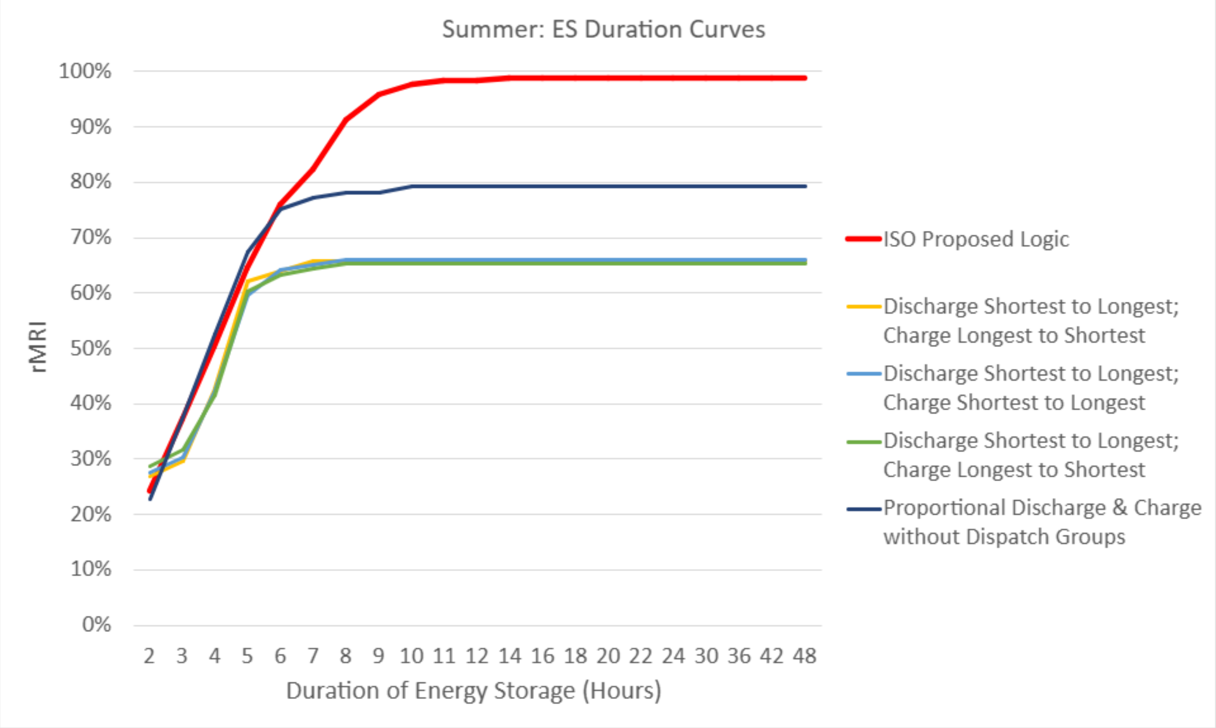
CAR-SA Preliminary Topic Schedule (Continued)

- The list below provides a draft projection of committee discussions:

Topics	Projected Committee Discussions
Technical Details	June – August
Redline Review	June (tentative) – September

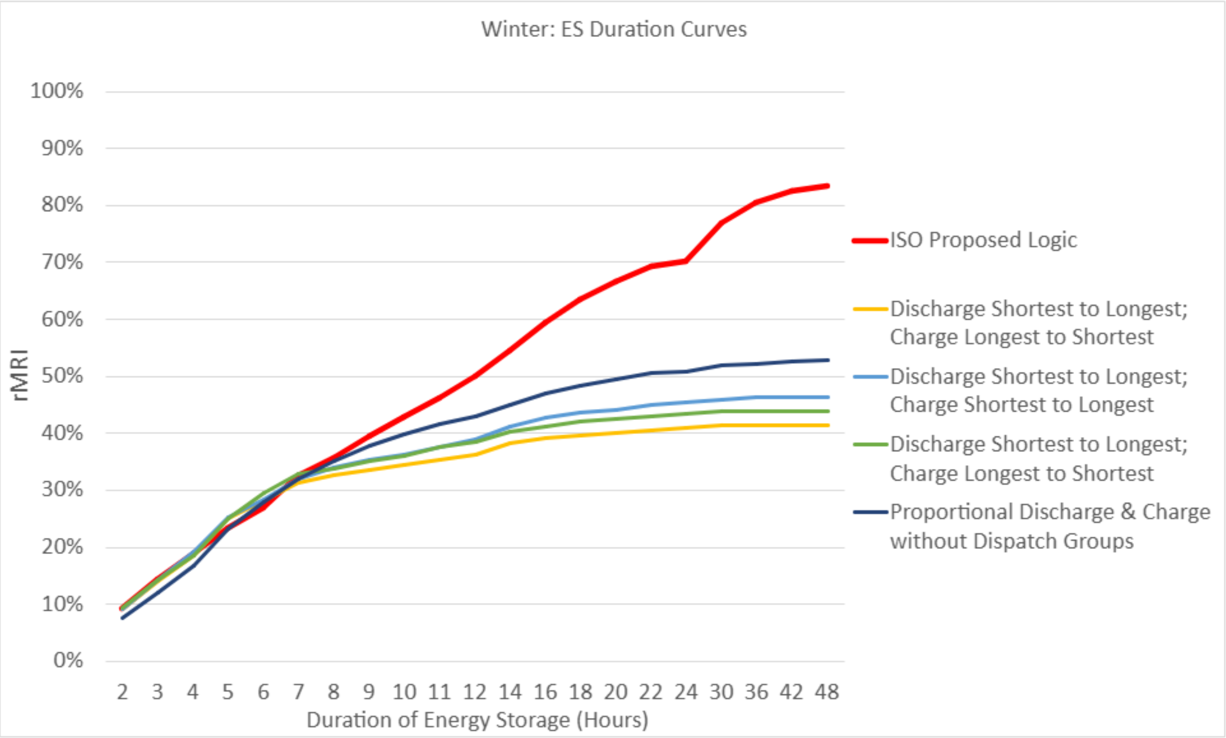
APPENDIX A: ADDITIONAL ANALYSIS OF ENERGY LIMITED AND STORAGE DISPATCH CONFIGURATIONS

ISO Proposed Logic vs. configurations that do not discharge long-to-short in summer



- Estimated summer rMRI for proxy energy storage resources with different durations, by discharging/charging configuration
  - Assumed 0% forced outage rate (EFORd)
- With most durations, energy storage resources would receive comparable or higher rMRI values with the ISO's proposed logic

ISO Proposed Logic vs. configurations that do not discharge long-to-short in winter

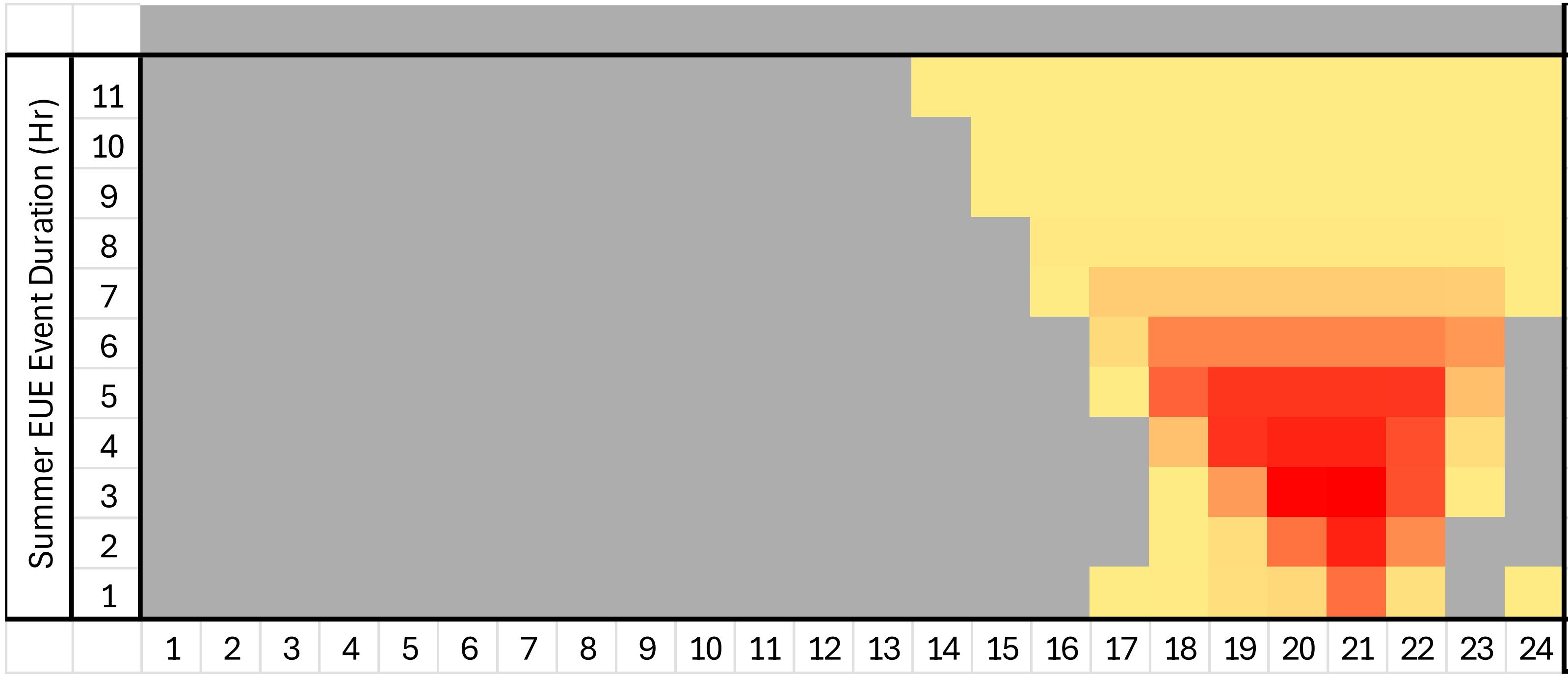


- Estimated winter rMRI for proxy energy storage resources with different durations, by discharging/charging configuration
  - Assumed 0 % forced outage rate (EFORd)
- For most durations, energy storage resources would receive higher (or comparable) rMRI values with the ISO's proposed configuration

APPENDIX B: ADDITIONAL ANALYSIS OF 80/20 LOLE SPLIT

Summer EUE Event Duration Pattern (80/20)

- Summer EUE events are typically short in duration, with nearly all lasting no more than 11 hours
  - Most events are shorter than 6 hours and occur within a single day
    - 2- and 3-hour events most commonly occur between HE20–22
    - 4-hour events are most likely between HE18–23
    - 5- and 6-hour events most frequently occur between HE17–23



Summer EUE Event Duration (Hr)	EUE hours	% of total EUE Hours	cumulative%
11	0.000	.0%	100.0%
10	0.000	.0%	100.0%
9	0.000	.1%	99.9%
8	0.003	1.0%	99.8%
7	0.015	5.6%	98.8%
6	0.043	15.8%	93.2%
5	0.064	23.3%	77.4%
4	0.056	20.6%	54.1%
3	0.050	18.1%	33.6%
2	0.030	11.1%	15.5%
1	0.012	4.4%	4.4%
	0.27		

- Squares that are more red represent hours within that event duration for which the likelihood of EUE is higher
- Median duration is 3 hours and mean duration is 3.41 hours

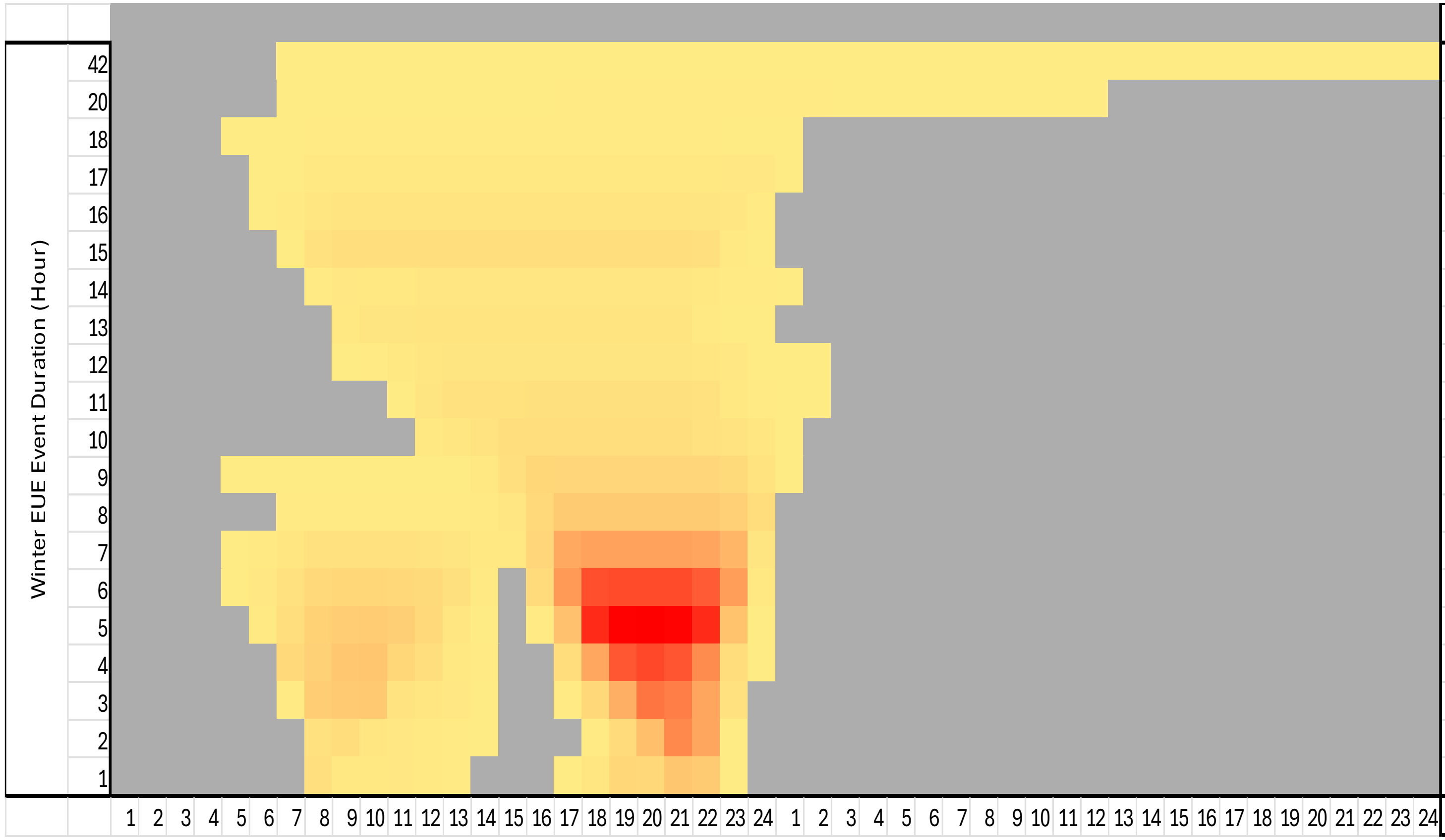
Winter EUE Event Duration Pattern (80/20)

- Winter EUE events are generally longer than summer events
  - While a few extreme events can span multiple days, these occurrences are rare
  - 99% of EUE hours occur in events lasting fewer than 17 hours, 90% in events under 12 hours, and 80% in events under 8 hours

Shorter events (1–6 hours) may occur in the morning (HE6–12) but are more frequently observed later in the day (HE17–23)

Longer events (7+ hours) tend to expand outward from the HE17–23 window, either: 1) starting earlier in the morning; 2) lasting later into the night; or 3) extending in both directions as event duration increases

Median duration is 5 hours and mean duration is 4.71 hours



Winter EUE Event Duration (Hour)	EUE hours	% of total EUE hours	cumulative %
42	0.000	0.2%	100.0%
20	0.000	0.4%	99.8%
18	0.000	0.4%	99.4%
17	0.001	1.2%	99.0%
16	0.002	1.9%	97.9%
15	0.003	3.2%	96.0%
14	0.001	1.1%	92.8%
13	0.002	1.5%	91.6%
12	0.001	1.3%	90.1%
11	0.002	2.0%	88.8%
10	0.002	2.3%	86.8%
9	0.003	3.2%	84.5%
8	0.005	4.5%	81.4%
7	0.010	9.4%	76.8%
6	0.019	17.6%	67.4%
5	0.023	21.6%	49.8%
4	0.014	13.2%	28.2%
3	0.009	8.2%	14.9%
2	0.005	4.4%	6.7%
1	0.002	2.3%	2.3%
	0.11		

Summer MRI Event Duration Pattern

- Consistent with the earlier analysis, the duration of MRI events is considerably longer, on average than that of EUE events

- A typical summer MRI event:
  - Begins with several discharging constrained hours in the afternoon to avoid load shed for as long as possible
  - Transitions in the late evening to EUE hours when there is no longer enough available energy to meet load

Note: Each cell in the overlay shows the magnitude of largest component
Type 1 (EUE hr) = Red; Type 2 (Discharging hr) = Green; Type 3 (Charging hr) = Blue

Summer MRI Event Duration (Hour) \ Hour Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Hours	% of total MRI Hours	Type 1 (%)	Type 2 (%)	Type 3 (%)
18																													
17								0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0%	59%	32%	9%
16									0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0%	56%	25%	19%
15								0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003	0%	46%	36%	18%
14									0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.005	1%	39%	42%	19%
13									0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001		0.009	1%	46%	42%	12%
12									0.000	0.000	0.000	0.001	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.000	0.023	3%	51%	44%	5%
11										0.000	0.000	0.001	0.007	0.007	0.007	0.007	0.006	0.005	0.007	0.007	0.007	0.007	0.006	0.000	0.078	11%	51%	47%	2%
10												0.000	0.006	0.011	0.011	0.011	0.010	0.006	0.008	0.010	0.011	0.011	0.004		0.109	16%	45%	54%	1%
9													0.000	0.021	0.022	0.022	0.021	0.016	0.011	0.018	0.021	0.021	0.000		0.195	28%	40%	60%	0%
8													0.000	0.010	0.018	0.018	0.018	0.016	0.011	0.012	0.018	0.008			0.148	21%	32%	67%	0%
7													0.000	0.000	0.013	0.015	0.015	0.013	0.009	0.010	0.014	0.001			0.103	15%	32%	68%	0%
6														0.000	0.001	0.003	0.003	0.002	0.001	0.002	0.001	0.000			0.015	2%	29%	71%	0%
5															0.000	0.001	0.001	0.001	0.001	0.001	0.000				0.004	1%	28%	72%	0%
4															0.000	0.000	0.000	0.000	0.000	0.000					0.001	0%	27%	73%	0%
3																													
																									0.694				

Winter MRI Event Duration Pattern

- In the winter, a typical MRI event runs longer and may span multiple days
- Consistent with the summer results, discharging hours precede EUE hours to reflect that the model uses any available stored energy before shedding load
- There are now also instances of charging MRI hours, where these often fall between periods of EUE hours

Note: Each cell in the overlay shows the magnitude of largest component
Type 1 (EUE hr) = Red; Type 2 (Discharging hr) = Green; Type 3 (Charging hr) = Blue

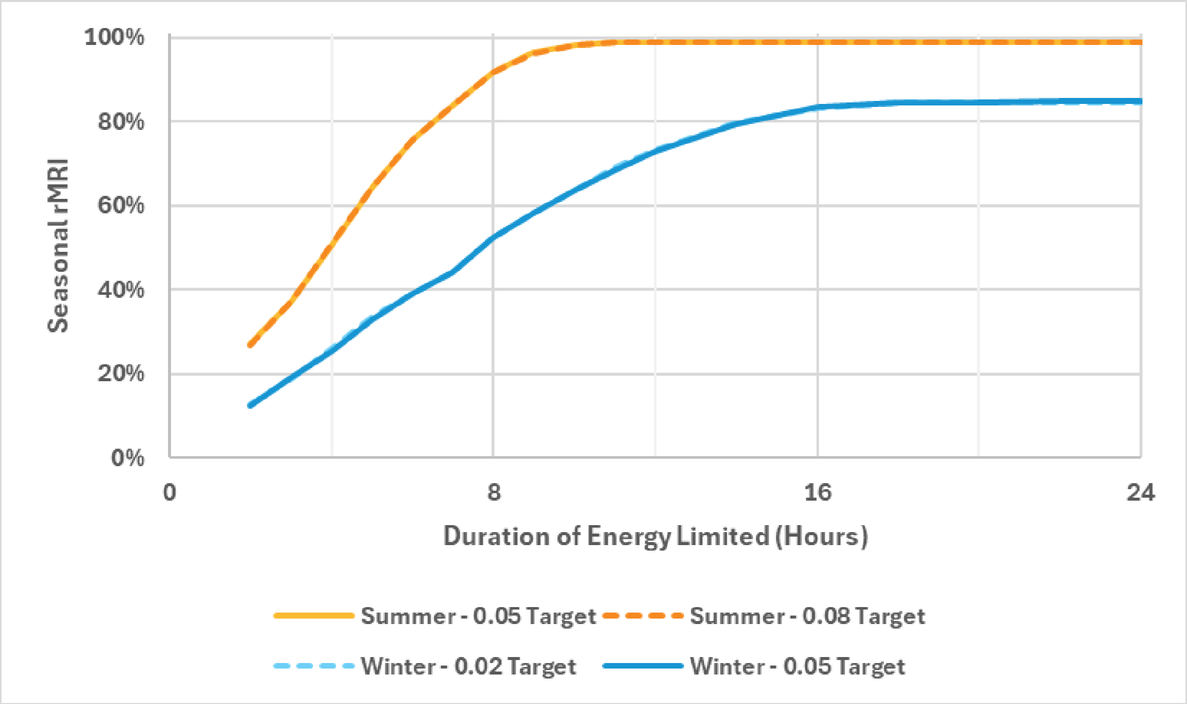
Winter MRI Event Duration (Hour)

Duration	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
64		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55											0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
54											0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
39		0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000
38		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.002	0.002	0.001	0.000
16	0.000	0.001	0.002	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.000	0.000
15		0.000	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.000	
14		0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	
13			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
9										0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8									0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
7										0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000	
6									0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000		

Duration	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	% of total MRI hrs	Type 1 (%)	Type 2 (%)	Type 3 (%)
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1%	45%	27%	28%
64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2%	50%	30%	20%
63	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2%	46%	33%	22%
55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1%	54%	24%	23%
54	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2%	35%	36%	29%
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		1%	42%	34%	24%
41	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		3%	45%	36%	20%
40	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000		7%	37%	39%	23%
39	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000			9%	34%	43%	23%
38	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			5%	33%	45%	23%
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		1%	45%	32%	22%
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		4%	35%	39%	26%
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			4%	31%	43%	26%
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				3%	33%	42%	25%
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000					2%	31%	48%	21%
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000															1%	32%	43%	25%
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000															3%	37%	50%	13%
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																10%	32%	59%	9%
16																									13%	26%	68%	6%
15																									10%	26%	71%	3%
14																									4%	24%	76%	1%
13																									2%	17%	83%	0%
9																									1%	45%	46%	10%
8																									1%	39%	53%	8%
7																									2%	44%	54%	2%
6																									1%	34%	65%	1%

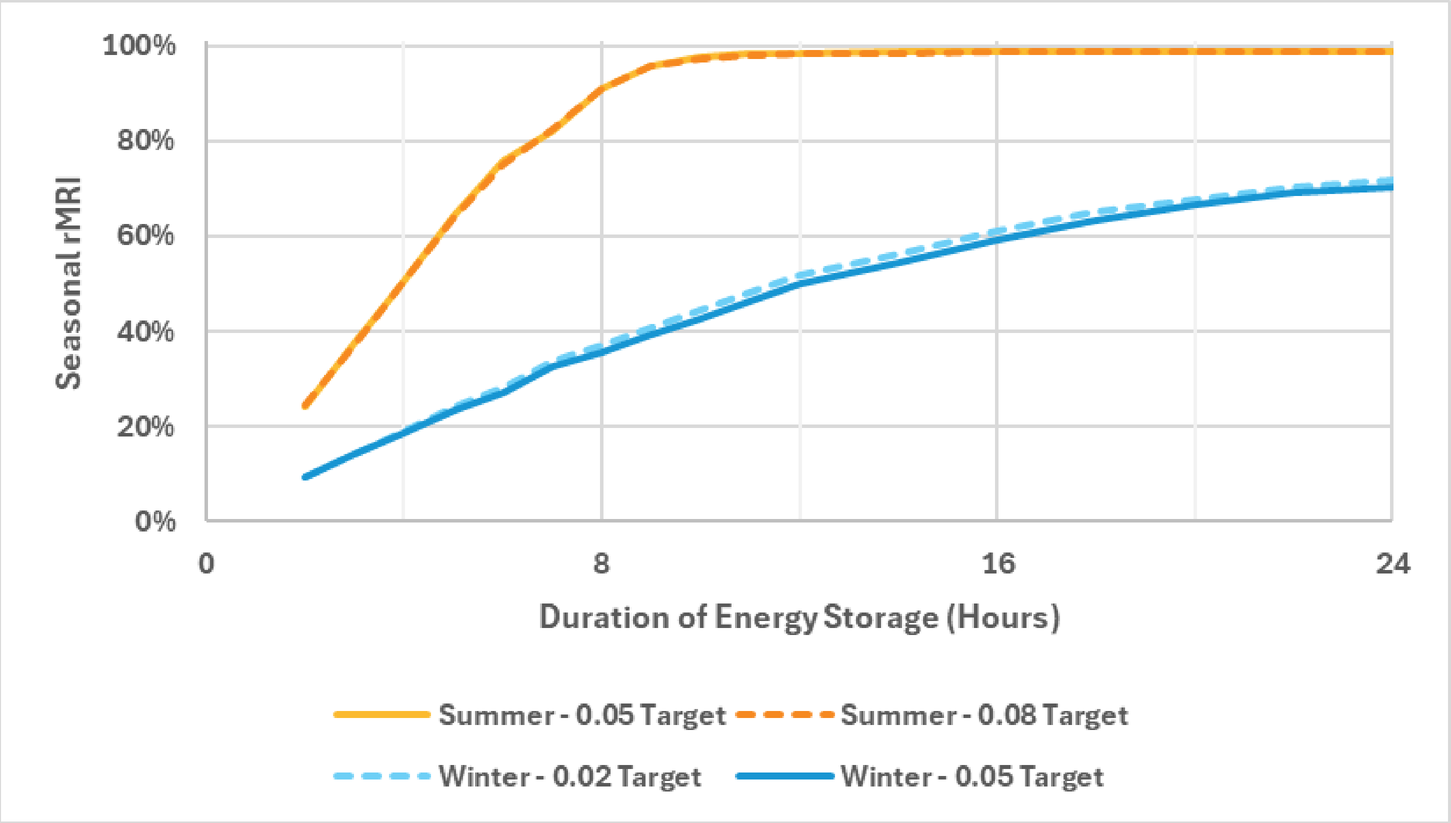
rMRI for Proxy Daily Energy Limited Resources

- There are no material changes in the rMRI values for Energy Limited Resources of different duration under the 80/20 split compared to the 50/50 split



rMRI for Proxy Energy Storage Resources

- rMRI values for longer duration energy storage resources increases slightly under the 80/20 split



APPENDIX C: OTHER FOLLOW UPS FROM NEAR-TERM BASE CASE

Additional Follow Ups

- In addition to the sensitivities and analysis provided above, there were a number of stakeholder questions/requests seeking to provide further clarity or context to the Near-Term Base Case results presented in March
- These include:
  - Additional information on the Net ICR calculations, including the ALCC values
  - Energy limited and storage duration curves that include an EFORd value
  - Further discussion of how ADCR profiles impact accreditation
  - Information on the normalization of MCap values for the 90/20 temperature values
- Next: Walk through ISO responses to these questions and requests

Detailed Net ICR Calculation

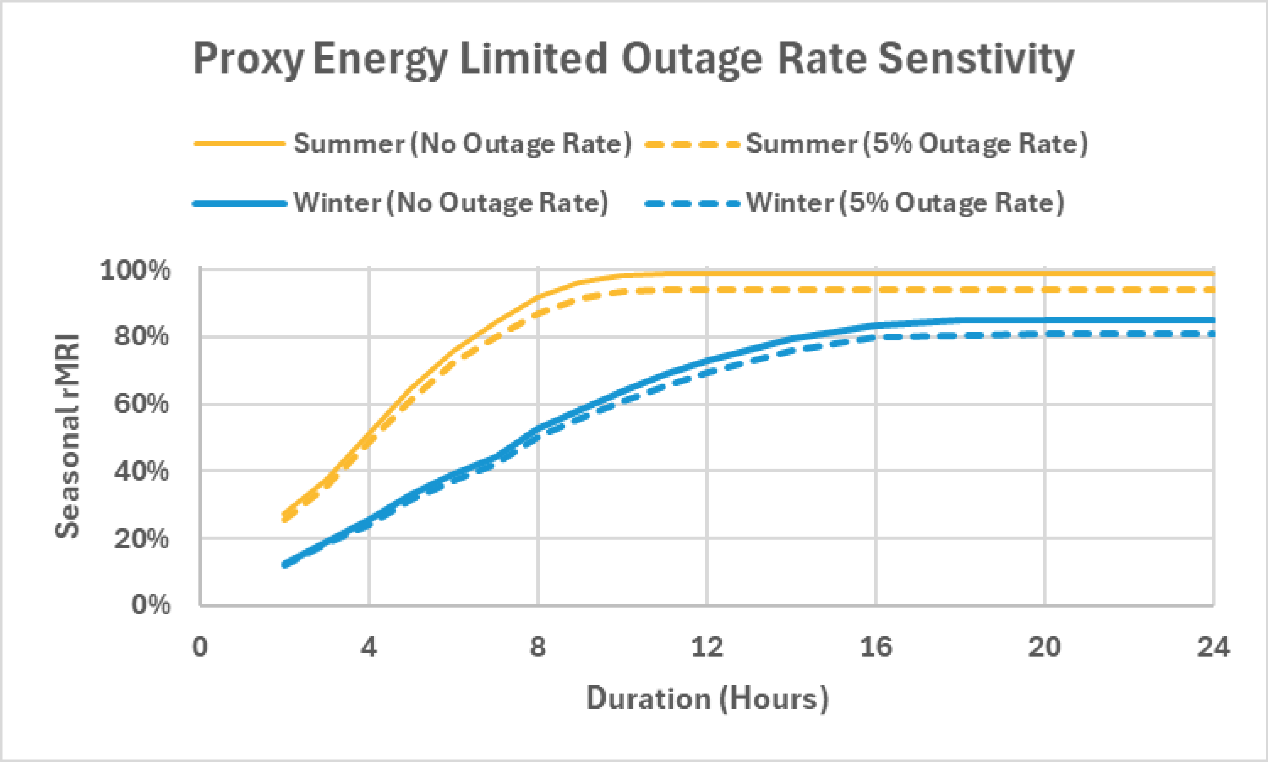
- Detailed net ICR calculation for Near-Term Base Case under CAR-SA current rules

	CAR-SA MCap (MW)		CAR-SA QC (MW)		Current Rule (MW in QC)
	Summer	Winter	Summer	Winter	
Generating Capacity Resources	34,072	35,661	30,339	32,243	30,339
Active Demand Capacity Resources	794	674	761	764	761
Passive Demand Resources	N/A	N/A	N/A	N/A	2,657
Import Capacity Resources	2,205	1,331	2,205	1,331	2,205
Total System Resources	**37,070**	**37,667**	**33,305**	**34,338**	**35,962**
Peak Load	25,124	21,101	25,124	21,101	27,781
ALCC (%)	15.78%	31.6%	15.78%	31.6%	15.14%
ALCC (MW)	**3,967**	**6,670**	**3,967**	**6,670**	**4,208**
Net ICR	**32,016**	**28,620**	**28,764**	**26,091**	**31,230**

$$Net\ ICR = \frac{Total\ Current\ Capacity}{1 + \frac{ALCC}{Peak\ Load}}$$

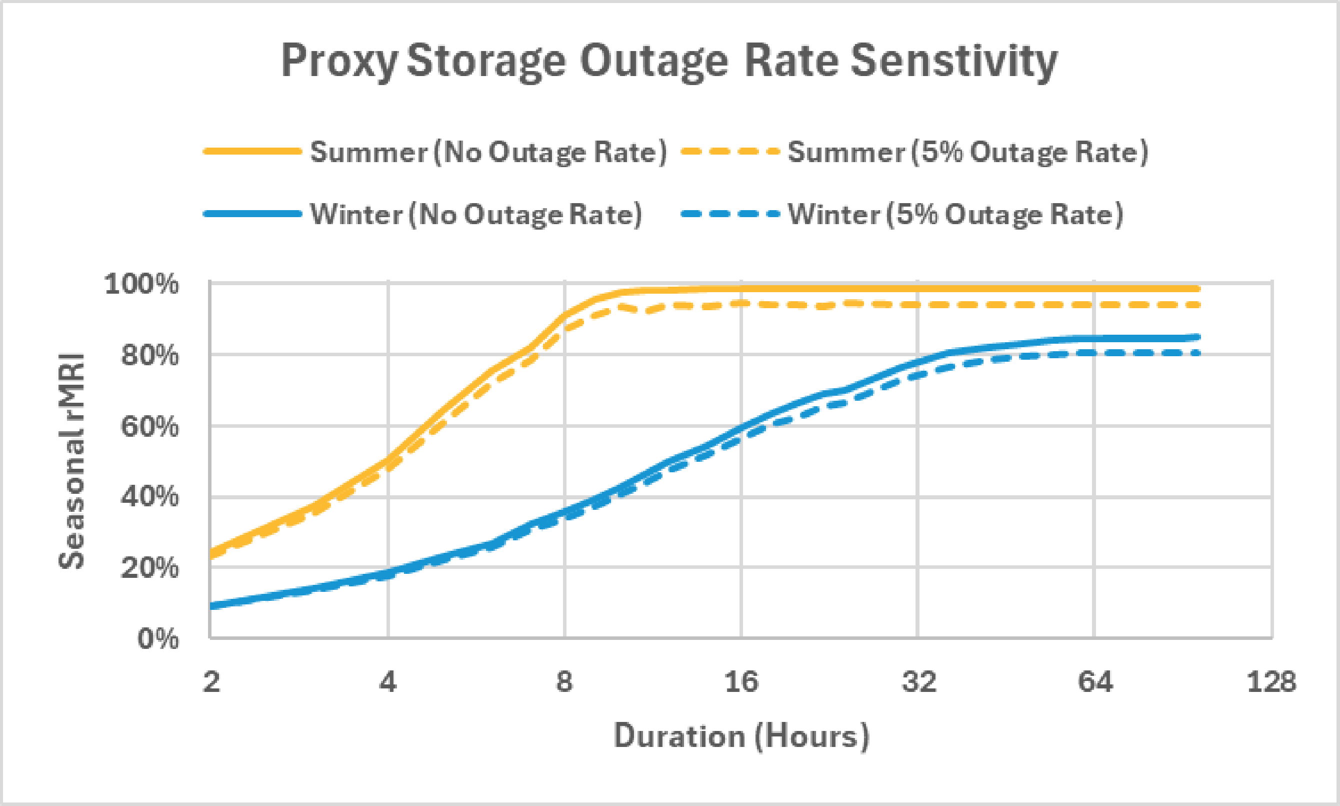
Proxy EL3 rMRI Curve w/ and w/o EFORd

- Overall, rMRI values are approximately 5% lower when EFORd impacts are taken into account for the energy limited resources



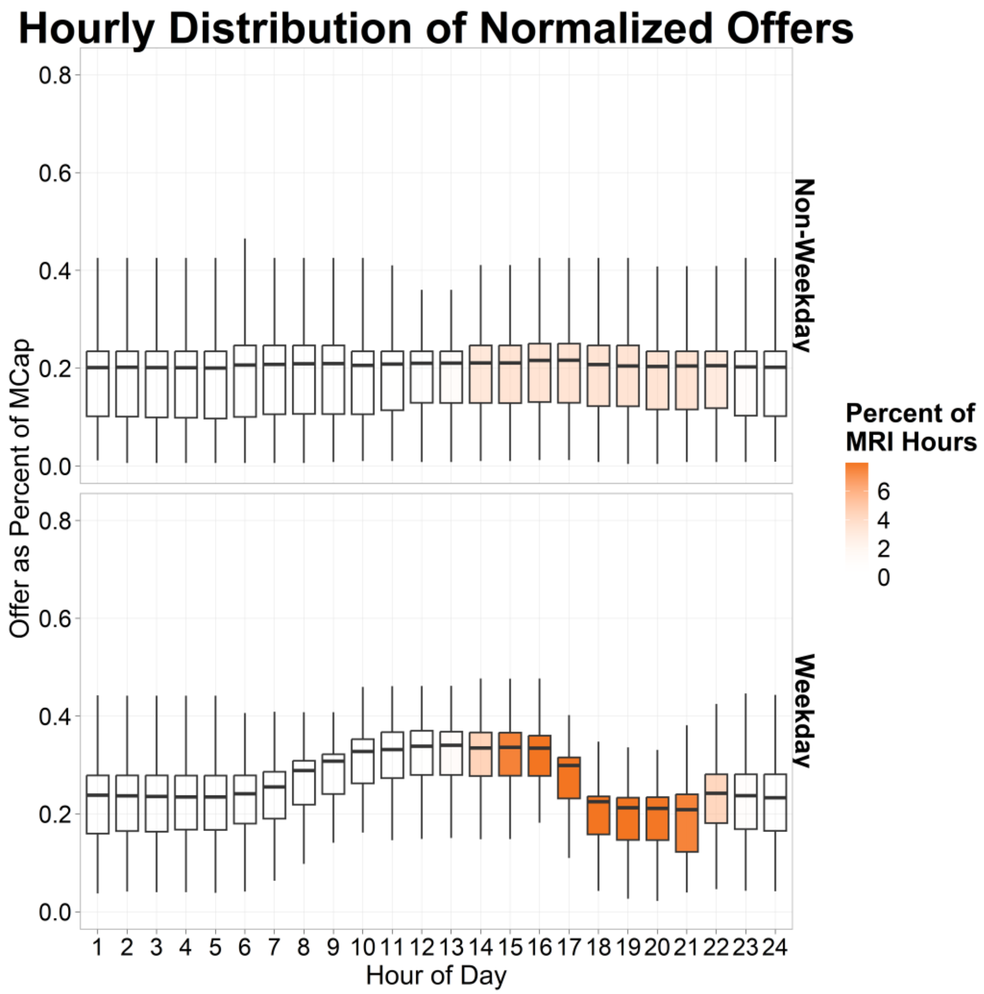
Proxy ES rMRI Curve w/ and w/o EFORd

- Similarly, rMRI values are approximately 5% lower when EFORd impacts are taken into account for the energy storage resources



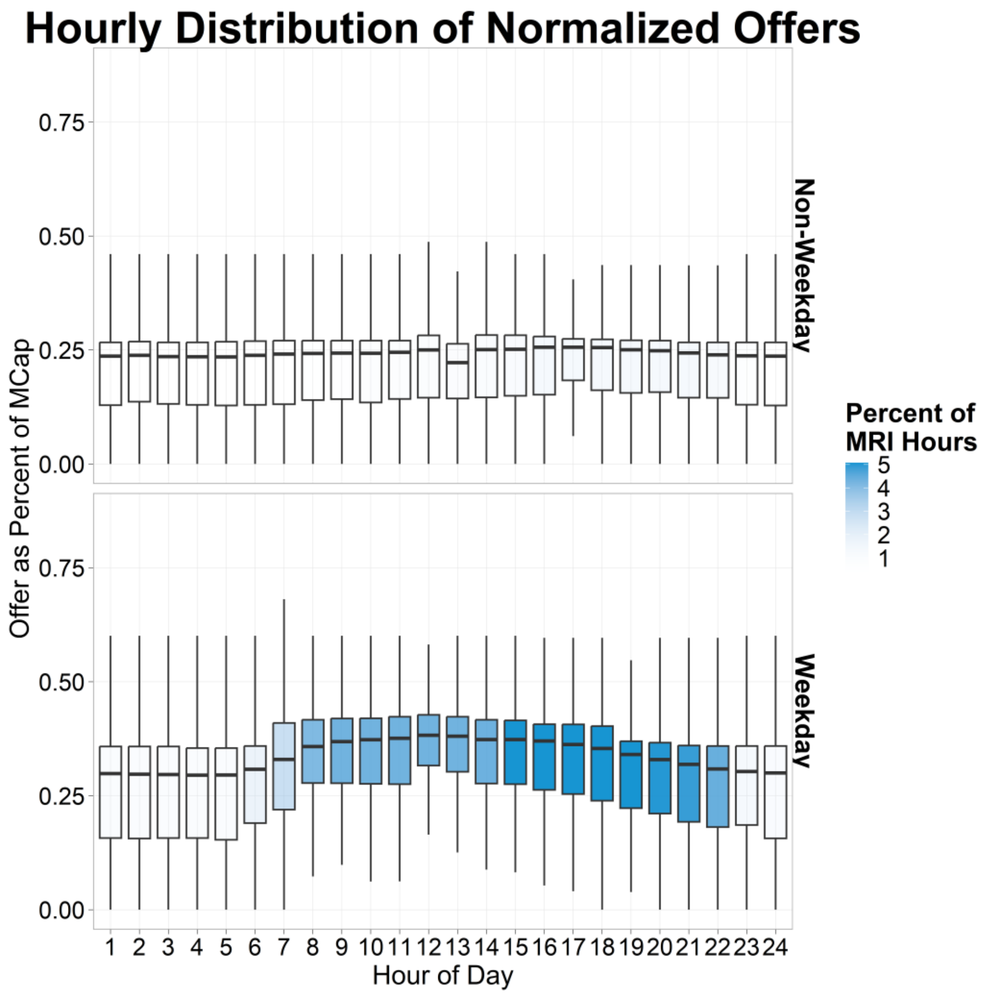
Summer ADCR Profiles and Effects on Accreditation

- ADCR offer-based profiles decline sharply during summer MRI hours, which typically occur on weekdays during HE15–HE21
- As a result, rMRI values are lower



Winter ADCR Profiles and Effects on Accreditation

- During winter, ADCR offer-based profiles are more levelized throughout the day and better aligned with the longer MRI hours
- As a result, winter rMRI values are higher.



Information on Normalizing Maximum Output to 90/20 Degree Seasonal Temperatures

- Information on how ambient temperatures drive capacity derates in the New England thermal fleet was shared in an April 2025 MC presentation, available at:
  - https://www.iso-ne.com/static-assets/documents/100022/a03.3_mc_2025_04_08-09_ambient_temps_iso_presentation.pdf